SOUTHEASTERN BIOLOGY

Volume 65 January-December, 2018 Numbers 1-4

THE 79TH ANNUAL MEETING OF THE ASSOCIATION OF SOUTHEASTERN BIOLOGISTS

BARUCH MARINE FIELD LABORATORY, GEORGETOWN, SC
COASTAL CAROLINA UNIVERSITY, CONWAY, SC
FRANCIS MARION UNIVERSITY, FLORENCE, SC
UNIVERSITY OF NORTH CAROLINA, PEMBROKE, NC
UNIVERSITY OF NORTH CAROLINA, WILMINGTON, NC

MARCH 28 -31, 2018

MEETING SITE: MYRTLE BEACH SHERATON AND CONVENTION CENTER, MYRTLE BEACH, SOUTH CAROLINA

Old Main, oldest building on the campus of the University of North Carolina at Pembroke.

The Official Publication of
The Association of Southeastern Biologists, Inc.
http://www.sebiologists.org

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SOUTHEASTERN BIOLOGY

(ISSN 1533-8436)

SOUTHEASTERN BIOLOGY (ISSN 1533-8436) is published online annually by the Association of Southeastern Biologists, Inc., Department of Biology, Bridgewater College, Bridgewater, VA 22812. Please send address changes to the Treasurer, Tracy Deem.

All contributions, inquiries and other matters should be addressed to the Journal Editor. Send books to be reviewed to the Book Review Editor.

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PURPOSE

The purpose of this association shall be to promote the advancement of biology as a science by encouraging research, the imparting of knowledge, the application of knowledge to the solution of biological problems, and the preservation of biological resources. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. See inside back cover.

TIME AND PLACE OF FUTURE MEETINGS

2018 March 28-31: Featured Institutions – Baruch Marine Field Laboratory, Georgetown, SC; Coastal Carolina University, Conway, SC; Francis Marion University, Florence, SC; University of North Carolina, Pembroke, NC; and University of North Carolina, Wilmington, NC. Meeting site is the Sheraton Myrtle Beach Convention Center Hotel, Myrtle Beach, SC.

THE VIEW FROM HERE

A MESSAGE FROM THE PRESIDENT
ASHLEY B. MORRIS

As I come to the end of my first year as President of ASB, I reflect on all that has changed (and stayed the same). I was first elected to the Executive Committee in 2010 as Member-at-Large. Over the last eight years, I've served in various elected capacities. Some may think this is too long of a period for one person to remain in ASB leadership. Others may think they have no interest in committing that amount of time to such positions. What I know now is that to really contribute to the kind of positive change we have experienced in ASB in recent years, we need long-term commitments. We need individuals who are energized, motivated, and genuinely interested in the betterment of ASB. It takes time to gain the institutional knowledge necessary to be able to truly understand how this organization functions and how we can make it better.

Why should we even care? ASB was the first presentation forum for me as a graduate student, and I know it was for many of you as well. This organization has played a vital role in my personal and professional development, and because of that, I owe all of you thanks. I owe all of you my time and my energy. I owe ASB for what it has done for me. I encourage you to consider what you can commit to this organization. What will you bring to ASB to support those first-time presenters? What will you bring to ASB to support your colleagues? What will *you* bring to ASB?

Our Executive Committee has worked tirelessly to bring ASB into the 21st century while attempting to maintain all that makes ASB so important to so many. We shifted to a new web platform, a new abstract submission platform, and a new app platform, all in an attempt to streamline and modernize the business of ASB. We worked to recruit nationally and internationally recognized biologists for our Plenary Speaker. We were excited to announce the first Lafayette Frederick Underrepresented Minorities Scholarship, developed in partnership between the ASB Human Diversity Committee and Dr. Frederick and his family. We continue to brainstorm ways to make our student-driven meeting a better networking opportunity for all involved. While looking back on all that we have accomplished this year, I look forward with great excitement to what we will bring you in 2019!

Sincerely,

Ashley B. Morris
President of ASB

ASB Prestigious Awards Presented at the 2018 Annual Meeting in Myrtle Beach, South Carolina

Hosted by

Baruch Marine Field Laboratory, Georgetown, South Carolina
Coastal Carolina University, Conway, South Carolina
Francis Marion University, Florence, South Carolina
University of North Carolina, Pembroke, North Carolina
University of North Carolina, Wilmington, North Carolina

ASB John Herr Lifetime Achievement Award

No award was made this year.

ASB Meritorious Teaching Award

University Professor Honored

Presented to **Dr. Howard Neufeld**
Appalachian State University, Boone, North Carolina

This prestigious award is sponsored by the Carolina Biological Supply Company, Burlington, North Carolina, includes a plaque, and a check for $1,500.00.

ASB Lucrecia Herr Outstanding Biology Teacher Award

High School Teacher Honored

Presented to **Kathy Seastead**
Nation Ford High School, Fort Mill, South Carolina

This prestigious award is sponsored by the ASB, includes a plaque, and a check for $750.00.

The Lafayette Frederick Underrepresented Minorities Scholarship

Presented to **Dominique Levy**
Georgia Gwinnett College, Lawrenceville, Georgia

This prestigious award is sponsored by ASB, includes a plaque, and a check for $1,200.00.

SUPPORT AWARD FOR GRADUATE STUDENT MEMBERS OF ASB

Presented to the following:

Courtney Alley, University of Tennessee at Chattanooga
Sarah Britton, Western Carolina University, Cullowhee, North Carolina
Clark Logan, Appalachian State University, Boone, North Carolina
Bleu Jackson, Middle Tennessee State University, Murfreesboro, Tennessee
Amanda Lafferty, Western Carolina University, Cullowhee, North Carolina
Paola Molina, Middle Tennessee State University, Murfreesboro, Tennessee
Kelde Mondar, Western Carolina University, Cullowhee, North Carolina
Emily Riffe, Appalachian State University, Boone, North Carolina
Lee Rumble, Middle Tennessee State University, Murfreesboro, Tennessee
Marietta Shattelroe, Appalachian State University, Boone, North Carolina
John Shelton, University of Tennessee at Chattanooga
Michael Sinclair, Virginia Commonwealth University, Richmond, Virginia
Kaitlyn Whitley, Appalachian State University, Boone, North Carolina
Lauren Wood, Virginia Commonwealth University, Richmond, Virginia
Kelly Zalaskus, Old Dominion University, Norfolk, Virginia

This prestigious award is sponsored by ASB, includes a check for $250.00, and a ticket to the ASB banquet.

ASB RESEARCH AWARD PRESENTATIONS

ASB SENIOR RESEARCH AWARD

Presented to **John Quinn**
Department of Biology, Furman University, Greenville, South Carolina

This award was presented to **John Quinn** for his manuscript entitled "Changes in spatial distribution of Southeastern salamanders in the Blue Ridge region with respect to future climate change scenarios." This research award is sponsored by the ASB, includes a plaque, and a check for $1,000.00.

ASB STUDENT RESEARCH AWARD

No award was made this year.

ASB Student Oral Presentation Awards

Awards, sponsored by ASB, in four categories were presented to each of four students who each received a plaque and a check for $300.00

1. **Animal Biology** – Presented to **Sarah Britton**, Western Carolina University, Cullowhee, North Carolina, for her paper entitled "Indirect effect of a competitor on life history and reproductive traits in a cavity nesting bird," meeting program page 19.

2. **Aquatic Biology** – Presented to **Harrison Seitz**, Highpoint University, Highpoint, North Carolina, for his paper entitled "An examination of UV radiation tolerance and photoenzymatic repair capabilities across temperature in the freshwater cladocerans *Scapholeberis mucronata*, *Diaphanosoma birgei*, and *Moina* spp," meeting program page 18.

3. **Cell and Molecular Biology** – Presented to **Ogechukwu Otiji**, Georgia Gwinnett College, Lawrenceville, Georgia, for his paper entitled "Do correlations exist between harm avoidance, risk assessment, the stin2 polymorphism, and marijuana use in college students?" meeting program page 19.

4. **Microbiology** – Presented to **John Spencer**, Columbus State University, Columbus, Georgia, for his paper entitled "The effects of antimicrobial peptides WAM-1 and LL-37 on multidrug resistant *Acinetobacter baumannii*," meeting program page 20.

ASB Student Poster Presentation Awards

Awards, sponsored by ASB, in four categories were presented to each of four students who each received a plaque and a check for $300.00

1. **Animal Biology** – Presented to **Amanda Lafferty**, Western Carolina University, Cullowhee, North Carolina, for her poster entitled "A comparison of habitat selection and cold tolerance of the invasive fire ant, *Solenopsis invicta*, in piedmont and montane regions of the Carolinas," meeting program page 26, poster no. 187.

2. **Aquatic Biology** – Presented to **Christopher Elsey**, Shorter University, Rome, Georgia, for his poster entitled "Investigation of the presence and identity of polychlorinated biphenyl (PCB) congeners in the Coosa River and its Rome tributaries in Floyd County, GA," meeting program page 23, poster no. 64.

3. **Cell and Molecular Biology** – Presented to **Emily Lucero**, Appalachian State University, Boone, North Carolina for her poster entitled "Macrophage susceptibility and behavior when exposed to oncolytic vesicular stomatitis virus," meeting program page 34, poster no. 239.

4. **Microbiology** – Presented to **Joshua Herndon**, University of Tennessee, Chattanooga, Tennessee, for his poster entitled "Exogenous polyunsaturated fatty acids (PUFAs) promote changes in growth,

phospholipid composition, membrane permeability and virulence phenotypes in *Escherichia coli*," meeting program page 33, poster no. 119.

EUGENE P. ODUM AWARD

The Eugene p. Odum Award, sponsored by the Southeastern Chapter of the Ecological Society of America, was presented to two recipients: (1) **Tesa Madsen-McQueen**, Appalachian State University, Boone, North Carolina, for her paper entitled "Environmental niche divergence in southeastern *Kalmia* species: integrating phylogeny, community, composition, and ecology," meeting program page 16, and (2) **Christopher Payne**, University of North Carolina Chapel Hill, Chapel Hill, North Carolina for his paper entitled "MultiEDA: An interactive exploratory data viewer for mulitvariate plot-based inventory data," meeting program page 15.

ELSIE QUARTERMAN-CATHERINE KEEVER AWARD

The Elsie Quarterman-Catherine Keever Award, sponsored by the Southeastern Chapter of the Ecological Society of America, was presented to **Mallory Munden**, University of North Carolina Wilmington, Wilmington, North Carolina, for her poster entitled, "The impact of crab pot distribution on diamondback terrapin presence in the waters around Masonboro Island, North Carolina," meeting program page 22, poster no. 33.

THE NORTH CAROLINA BOTANICAL GARDEN AWARD

The North Carolina Botanical Garden Award, sponsored by the NC3G, Chapel Hill, North Carolina, was presented to **Byron Burrell**, for his paper entitled "Habitat preference and herbivory effects in a rare plant preserve with reduced human interaction," meeting program page 18.

BOTANICAL SOCIETY OF AMERICA

SOUTHEASTERN SECTION STUDENT AWARDS IN PLANT SCIENCE

The Botanical Society of America Southeastern Section Student Awards, sponsored by the SE Section of the BSA, presented two awards—one for best paper presentation and one for best poster presentation.

1. The paper presentation was awarded to **Tesa Madsen-McQueen**, Appalachian State University, Boone, North Carolina, for her paper entitled, "Environmental niche divergence in southeastern *Kalmia* species: integrating phylogeny, community, composition, and ecology," meeting program page 16.
2. The poster presentation was awarded to **Lee Rumble**, Middle Tennessee State University, Murfreesboro, Tennessee, for her poster entitled "Measuring spatial and temporal shifts in forest structure and

composition post-beech bark disease in Great Smoky Mountains National Park," meeting program page 27, poster no. 253.

SOUTHERN APPALACHIAN BOTANICAL SOCIETY AWARDS

Presented on March 30, 2018.

Earl Core Student Research Award

Dr. Earl Core was a major force in the founding of the Southern Appalachian Botanical Club in 1936. The annual Core Student Award was established by the society to provide financial assistance in support of student research projects in plant taxonomy, systematics, and ecology. For 2018 two proposals were funded.

Nicholas Flanders (Old Dominion University) – "Effects of environmental conditions on early survival of a bird-dispersed mistletoe, *Phoradendron leucarpum*"- The funded amount was $761.21.

Jonathan Kleinman (University of Alabama) – "Trait-based plant response to wind, logging and prescribed fire in *Pinus* woodlands" His funded amount was $1,120.

Richard and Minnie Windler Award

The Richard and Minnie Windler Award was established by Dr. Donald R. Windler of Towson University as a memorial to his parents. Two awards are presented annually; first to the author or authors of the best systematic botany paper and second for the best ecology or floristic paper, both published in *Castanea* during the previous year. Each award comes with a check for $500.
The 2018 Richard and Minnie Windler Award winners for the best Ecology and Systematics botany papers published in *Castanea* during 2017 were:

Ecology – **Shannon N. Grover, Jesse E. D. Miller and Ellen I. Damschen** for their paper "Indirect Effects of Landscape Spatial Structure and Plant Species Richness on Pollinator Diversity in Ozark Glades." This was published in the Spring 2017 issue of *Castanea*.

Systematics – **John H. Wiersema, Piero G. Delprete, Joseph H. Kirkbride Jr. and Alan R. Franck** for their paper "A New Weed in Florida, *Spermacoce latifolia*, and the Distinction between *S. alata* and *S. latifolia* (Spermacoceae, Rubiaceae)." This was published in the Fall 2017 issue of *Castanea*.

Student Travel Awards

This is an award to assist students attending the Association of Southeastern Biologists (ASB) meeting each year. The award is available to undergraduate and graduate students presenting a paper or poster with a botanical focus at the annual ASB/SABS meeting.

The 2018 awardees were **David Bailey** (Winthrop University), **Taylor Gray** (Western Carolina University), **Anna McCormick** (Western Carolina University), **Ashleigh Nelson** (Abraham Baldwin Agricultural College), **Ellen Quinlan** (Western Carolina University), and **Emily Riffe** (Appalachian State University).

Student Presentation Awards

The Student Presentation Awards were established to reward outstanding undergraduate or graduate student botanical presentations at the annual Association of Southeastern Biologists meeting. For 2018, awards were presented for the best student poster presentation and for best oral presentation. Each award includes an honorarium of $300.

Student Oral Presentation – **Tesa Madsen-McQueen** (Appalachian State University), "Environmental niche divergence in Southeastern *Kalmia* species; integrating phylogeny, community composition and ecology."

Student Poster Presentation – **David Lee Rumble** (Middle Tennessee State University), "Measuring spatial and temporal shifts in forest structure and composition post-beech bark disease in Great Smoky Mountains National Park."

John E. Fairey Scholarship

SABS commemorates the legacy of Dr. John E. Fairey III. He earned his MS and PhD degrees at West Virginia University under the supervision of Dr. Earl Core, one of the society's founders. Dr. Fairey served as Vice-President and President and subsequently remained active with the society for the rest of his life. The Fairey Scholarship provides financial support for undergraduate or graduate students to attend botany workshops or courses taught at biological field stations.

The 2018 winner is **Emily Ulman** (North Carolina State University). She took a course at Highlands Biological Station in July.

Elizabeth Ann Bartholomew Award

No award was made this year.

ORAL PRESENTATIONS

1084 - Influences on the Presence of Invasive Plant Species within Old Growth Forest of Lilley Cornett Woods

Jacob Peters[1], Jennifer Koslow[2], Alex Baecher[3]

[1]University of Virginia's College at Wise, Wise, VA, [2]Eastern Kentucky University, Richmond, KY, [3]Memphis Zoo, Memphis, TN

Old growth forests may appear to be more resistant to invasive plant species, but they are still not immune. There are several factors that may increase or decrease the likelihood of invasion such as slope, elevation, and distance from disturbance. This study focused on the presence of four key invasive plants—Microstegium vimineum (Japanese stilt grass), Rosa multiflora (multiflora rose), Ailanthus altissima (tree of heaven), and Paulownia tomentosa (princess tree)—at Lilley Cornett Woods in eastern Kentucky. Data were collected on the presence of invasive plants on 94 long-term monitoring plots and linked with canopy openness, as well as geographical and topographical parameters to determine which factors influence the probability of invasion. Data were analyzed using generalized linear models, which were averaged using multi-model inference. While closer proximity to developed areas increases propagule pressure, canopy openness was the most influential factor on the establishment of invasive species, likely acting as a platform for them to gain a foothold in old-growth and thus creating an opportunity for them to spread throughout the forest.

1102 - The Effect of Different Fish Predators on Riparian Spider Mercury Concentrations

Gale Beaubien[1], Connor Olson[1], Scott Rush[2], Ryan Otter[1]

[1]Middle Tennessee State University, Murfreesboro, TN, [2]Mississippi State University, Starkville, MS

Riparian spiders in the families Tetragnathidae (horizontal web-builders) and Araneidae (vertical web-builders) feed primarily on aquatic emergent insects and have been used as bioindicators of aquatic contaminants including mercury and polychlorinated biphenyls (PCBs). However, use of these spiders as tracers of contaminants in aquatic systems is limited by complex interactions that can affect the %-contribution of emergent insects assimilated by these predators. The objective of this study was to determine if the presence of different fish predators impact the mercury concentration in riparian spiders and if methylmercury (MeHg) measured in these riparian spiders exceed thresholds of concern. Three sites were selected in the Appalachian Mountains; two sites have a barrier separating downstream rainbow trout (Oncorhyncus mykiss) from upstream eastern brook trout (Salvelinus fontinalis) populations while the third site has sympatric populations of rainbow trout and eastern brook trout. In August of 2016, 10 eastern brook trout and 10 rainbow trout were collected from established stream reaches along with riparian spiders from both families. Fish stomachs and caudal fins were excised and remaining whole-body homogenates were analyzed for total-mercury and methyl-mercury concentrations (Upstream Eastern Brook Trout THg: 48.7 µg/kg ± 4.3 SE and MeHg: 45.9 µg/kg ± 5.4 SE; Downstream Rainbow Trout THg: 38.6 µg/kg ± 4.3 SE and MeHg: 37.8 µg/kg ± 4.3 SE). At each site, spiders were separated by family, homogenized into three samples, and then analyzed for total-mercury (Upstream Tetragnathids THg: 280.7 µg/kg ± 63.1 SE and Araneid THg: 93.9 µg/kg ± 16.3 SE; Downstream Tetragnathid THg: 196.7 µg/kg ± 16.6 SE and Araneid THg: 110.0 µg/kg ± 21.7 SE). At all sites spiders exceeded calculated mercury risk threshold concentrations determined for black-capped chickadee (Poecile carolinensis) nestlings, one of the organisms known to feed directly on these spiders.

1103 - Conspecific negative density dependence in American beech

Benjamin Ramage, Isabel Mangana

Randolph-Macon College, Ashland, VA

One of the most important drivers of forest biodiversity is conspecific negative density dependence (CNDD), a reduction in performance when conspecific densities are high. While the majority of CNDD research has focused on tropical forests, evidence is mounting that CNDD may also play an important role in temperate forests. To further explore the potential reach of this phenomenon, we investigated CNDD in American beech (*Fagus grandifolia*) in a mature mid-Atlantic forest. We used bivariate point pattern analyses to examine spatial relationships between large beech trees and conspecific saplings, and we also compared these patterns to comparable patterns for heterospecifics. In addition, to address the possibility of dispersal limitation and the associated effects on spatial patterns, we analyzed seedling density as a function of adult conspecific abundance. We found that beech saplings were more repelled from large conspecifics than large heterospecifics, despite the fact that beech seedling density was positively correlated with beech basal area. However, saplings of other canopy tree species were also repelled from adult beech trees, suggesting a general suppressive effect. Nonetheless, the discrepancy between beech seedling and sapling densities beneath adult conspecifics suggests that beech seedling survival rates were reduced in vicinity of conspecific adults. This is important for biodiversity maintenance, even if beech also inhibits most other tree species, because it prevents a dense layer of shade-tolerant beech saplings from forming beneath adult beech trees. If this were to occur, beech would have a substantial head-start following canopy disturbance, and this late-successional species could potentially dominate a stand in perpetuity, through repeated disturbance cycles. Instead, the CNDD we have documented likely enables other species to establish post-disturbance, thereby increasing local diversity.

1110 - Standing dead trees are a conduit for the atmospheric flux of CH_4 and CO_2 from wetlands

Mary Jane Carmichael[1], Ashley Helton[2], Joseph White[3], William K. Smith[4]

[1]Hollins University, Roanoke, VA, [2]The University of Connecticut, Storrs, CT, [3]The University of North Carolina at Pembroke, Pembroke, NC, [4]Wake Forest University, Winston-Salem, NC

In vegetated wetland ecosystems, plants can be a dominant pathway in the atmospheric flux of methane, a potent greenhouse gas. Although the roles of herbaceous vegetation and live woody vegetation in this flux have been established, the role of dead woody vegetation is not yet known. In a restored wetland of North Carolina's coastal plain, static flux chambers were deployed at two heights on standing dead trees to determine if these structures acted as a conduit for methane emissions. Methane fluxes to the atmosphere were measured in five of the chambers, with a mean flux of 0.4±0.1 mg m^{-2} h^{-1}. Methane consumption was also measured in three of the chambers, with a mean flux of -0.6±0.3 mg m^{-2} h^{-1}. Standing dead trees were also a source of the flux of CO_2 (114.6±23.8 mg m^{-2} h^{-1}) to the atmosphere. Results confirm that standing dead trees represent a conduit for the atmospheric flux of carbon gases from wetlands. However, several questions remain regarding the ultimate source of these carbon gases, the controls on the magnitude and direction of this flux, the mechanisms that induce this flux, and the importance of this pathway relative to other sources at the landscape level.

1123 - The Effects of Bromocriptine on the Mobility of *Caenorhabditis elegans* with Parkinson's-like Disease

Midya Yarwais, Nick Ragsdale

Belmont University - Nashville, TN, Nashville, TN

Ten million people worldwide are affected with Parkinson's disease (PD). It is characterized by the loss of dopamine neurons in the brain, thus affecting a person's movement and cognition. Pharmaceuticals have provided treatments that slow down the progression of the disease. Overtime, the body stops responding to these medications. Bromocriptine is a drug that has been used for diabetes and prolactin related issues. Additionally, it has shown promising results for alleviating symptoms associated with Parkinson's. Research suggests that bromocriptine protects dopaminergic neurons during times of oxidative stress. In this research, the protective affect of bromocriptine on the movement of *Caenorhabditis elegans* with PD-like disease was investigated. Results suggest that bromocriptine's neuroprotective effect does restore normal locomotion in worms with Parkinson-like disease

1124 - Investigating the Effect of the NMDA-type Neurotransmitter Glutamate on Habituation in *Caenorhabditis elegans*

Yasmin Telwar, Nick Ragsdale

Belmont University - Nashville, TN, Nashville, TN

NMDA-type (N-methyl-D-aspartate) receptors are ion channel proteins that bind to glutamate. This is uniform in both humans and *Caenorhabditis elegans (C. elegans).* The *nmr-2* gene codes for a subunit of the glutamate receptor in *C. elegans.* Current literature links glutamate to associative learning and memory formation. There has not been a connection made with forms of non-associative learning and the NMDA-type receptor. Habituation is considered the simplest form of non-associative learning. This experiment attempts to determine the role of glutamate receptors in habituation in *C. elegans.* It is hypothesized that the elimination of a functional glutamate receptor will result in the inability to habituate. The results do not support the hypothesis

1126 - A study of Autumn Olive (*Elaeagnus umbellata*) phenology and associated physiological traits that may facilitate its invasion of the understory of a Southern Appalachian forest

Emily Riffe, Ivy Culver, Howard Neufeld

Appalachian State University, Boone, NC

Elaeagnus umbellata, better known as Autumn Olive (AO), is an exotic tree species that has invaded much of the eastern United States. It grows in a variety of habitats, but little is known about its ability to invade and persist in forest understories, especially at high elevations in the southern Appalachians. AO may take advantage of high light conditions before canopy leaf out and after canopy leaf fall by leafing out early and maintaining leaves late into the fall. This would allow AO access to high light in early spring and late fall, when it may gain most of its carbon. To address this hypothesis, we made phenological and gas exchange measurements throughout 2017. AO began leafing out in mid-February while native understory species didn't leaf out until early April, and canopy trees until mid-April. Peak leaf number for AO was reached in early June and survivorship followed a Type I curve through the season, with 6% of leaves still remaining by mid-November. We also measured diurnal patterns of gas exchange at approximately monthly intervals using the Li-6800 gas exchange system. Peak carbon gain of 161.0 mmol CO2 m-2 day-1 occurred in May while AO had an average carbon gain of only 10.6 mmol CO2 m-2 day-1 during the summer months, when light levels were much lower. The carbon gain increased again during the fall with an October rate of 90.6 mmol CO2 m-2 day-1. As hypothesized, rates of carbon dioxide uptake by AO were higher in spring and fall when light levels were higher versus in summer when they were lower, suggesting that most of its annual carbon is gained during those periods when the overstory is leafless. The nearly two months of extended phenology gives AO a physiological advantage over native species, thereby contributing to its invasiveness.

1128 - Long-term impacts of rising atmospheric carbon dioxide on coastal scrub-oak vegetation in Florida

Frank Day

Old Dominion University, Norfolk, VA

The link between rising atmospheric CO_2 and global warming has received much attention, but the direct effects of elevated CO_2 on natural ecosystems are equally important. Vegetation responses in a scrub-oak ecosystem in Florida were observed in open-top chambers exposed to 11 years of elevated atmospheric CO_2. These systems are of particular interest because they are disturbance driven (coastal storms and fire) and recovery from these disturbances occurs through resprouting from extensive belowground structures. After 11 years, total root biomass was greater in elevated than in ambient plots. Fine root biomass fluctuated by more than a factor of two, with no unidirectional temporal trend, whereas leaf biomass accumulated monotonically. Strong increases in fine root biomass with elevated CO_2 occurred after fire and hurricane disturbance. Leaf biomass also exhibited stronger responses following hurricanes. Responses after fire and hurricanes suggest that disturbance enhances the growth responses of plants to elevated CO_2. Increased resource availability associated with disturbance (nutrients, water, space) may facilitate greater responses. Process rates are dramatically affected while exposed to elevated CO_2 but are there long-term changes to the fundamental structure of the system? We sought to determine if elevated CO_2 resulted in long lasting changes to plant structure and function, particularly disturbance response patterns. We examined above and belowground biomass inside the footprints of chambers 7 years after CO_2 enrichment ceased and 2 years after fire. Aboveground biomass was 41% higher in the previously elevated plots compared to ambient plots, suggesting there are legacy effects from previous exposure to elevated CO_2. Following disturbance, regrowth occurs via sprouting from large belowground structures, thus changes in aboveground recovery are likely due to fundamental changes to belowground structures caused by altered atmospheric CO_2.

1143 - Flora of Stone Mountain based on Digitized Specimens in the University of Georgia Herbarium

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Stone Mountain Park, DeKalb County, Georgia, comprises 1,300 ha (3,212ac) owned by the state of Georgia and administered by the Stone Mountain Memorial Association. Stone Mountain, located at the center of the park, is one of the world's largest exposed granite monoliths, covering 240 ha (593 ac) with an elevation of 514 m (1,670 ft) at its summit. The University of Georgia Herbarium has 1,205 vascular plant vouchers collected from Stone Mountain Park dating from 1843 to 2011, and 689 were collected for a floristic survey conducted by Michael Moore and David Giannasi in the mid-1990's. The goals of this project were to: (1) compile all specimen label data for the park, (2) georeference and plot each specimen, and (3) create a vegetation map of the park based on label data. Specimen label data and various map resources were used to plot the locality of each specimen. GPS coordinates, assigned through GeoLocate, combined with label habitat data and infrared imagery, were used to make a general vegetation map of Stone Mountain Park. The 598 specimens with vague locality data were assigned the centroid GPS coordinate of the park. The vouchers comprised 721 species, and 18 percent were exotic.. The four largest families were Asteraceae (96 spp.), Poaceae (71 spp.), Fabaceae (50 spp.), and Cyperaceae (33 spp.). Three state-ranked rare plant species (S1, critically imperiled) or S2 (imperiled) occur within Stone Mountain Park: Anemone berlandieri, Isoetes melanospora, and Waldsteinia lobata.

1166 - Food web ecology and keystone effects of an endemic pond-breeding salamander

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Keystone species have disproportionately large effects on communities relative to their abundance. One way keystone predators affect communities is by decreasing the relative abundance of superior competitors, relieving competitive pressure and increasing relative abundance of inferior competitors - and consequently, increasing local biodiversity. Thus, their identification and management is of great conservation concern. Additionally, functional redundancy explains how different species in the same trophic level can have either additive or redundant effects on community composition. In pond communities, the fall-breeding marbled salamander (*Ambystoma opacum*) can act as a keystone predator and increase tadpole diversity via selective predation. However, the ability of other fall-breeding ambystomatids to also play a keystone role is poorly understood. A congeneric endemic species, the ringed salamander (*Ambystoma annulatum*), can co-occur with *A. opacum* in Missouri, and has a similar fall-breeding phenology. To evaluate the conditions under which these two ambystomatid salamanders can act in keystone roles and the potential for functional redundancy, we conducted an artificial pond experiment with a diverse assemblage of anuran tadpole prey in four different experimental food webs. We found that *A. annulatum* promotes tadpole biodiversity when alone. However, food webs with *A. opacum* alone showed no significant increase in tadpole diversity (i.e. no keystone effect) thus reducing the possibility for functional redundancy between these two predators. The similarities in life history and phenology of *A. annulatum* to *A. opacum* suggested that they should have similar effects on tadpoles; however, the observed lack of redundancy between the species indicates the importance of geographic variation and evaluating the ecological roles of endemic species. In the future, a better understanding of geographical variation in whether species function as keystones and the ecosystem-level impacts of keystone predators can facilitate management decisions to promote greater biodiversity.

1183 - Visitor Perceptions of White Nose Syndrome Management

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Bats fulfill several important roles in the ecosystem, including those of pollinators and insectivores. However, bats face a serious threat from White Nose Syndrome (WNS). WNS is a rapidly-spreading fungal disease currently decimating North American bat populations. Although directly treating the bats is an option, managing the human impact is equally critical. This study was conducted by developing and administering visitor surveys in the London and Cumberland Districts of the Daniel Boone National Forest, Kentucky. The survey gathered information about visitor knowledge and awareness of WNS, general demographic information, and visitor opinions on potential management strategies to be implemented in the DBNF. While seventy-eight percent of visitors have seen bats, only forty-four percent had heard of WNS. The management option most supported by visitors was rehabilitation, followed by visitor decontamination when entering and leaving caves. Visitors who had heard of WNS were significantly more likely to believe that bats were important, but there was no significant correlation with the number of management or treatment policies supported. The low awareness of WNS suggests that increased education is needed before and during implementation to safeguard bat populations. The survey results highlight the demographics and topics that should be targeted for education, and the results can be useful for guiding management policies in the future.

1185 - Cytogenetic tools to investigate the compilospecies

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A compilospecies is defined as a genetically aggressive taxa that "steals" or incorporates the genomes of other taxa via introgressive hybridization. This concept was first defined in *Bothriochloa, Capillipedium*, and *Dichanthium* (the BCD clade). Within this clade, *Bothriochloa bladhii* was identified as the compilospecies. Proper cytological techniques and accurate chromosome counts are needed to begin investigations to understand the mode of hybridization and to track "dominant" genomes. Techniques for preparation of meiotic chromosome spreads in species with more than 60 chromosomes are lacking in the literature. We have developed a modified steam drop method that results in consistent meiotic chromosome spreads. Steam and refixation are used to swell cells and spread chromosomes to avoid overlap and ensure accurate counts. Chromosomes prepared by this method are suitable for use in FISH and other analyses.

1190 - Survival and habitat selection of Eastern Box Turtles (*Terrapene carolina*) in fire-maintained forests

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Prescribed fire is an essential tool for the conservation and management of longleaf forests, and it is thus widely employed in the Southeastern United States. While such management practices may result in the unintentional injury or killing of box turtles, we know little regarding how turtles respond behaviorally, nor do we understand how such fires affect survival. From 2012 – 2016, we assessed responses of box turtles to fire at Weymouth Woods Sandhills Nature Preserve (WEWO) relative to turtles at the nearby Lumber River State Park (LRSP) where fire is not used in management. Annual survivorship ranged from 85.8 – 91.3 % for the various site and sex group combinations. Survival models indicated sex, site, and season-specific variation, with males experiencing 6.8 % higher annual survival than females, and turtles from the unburned site (LRSP) having 4.9 % higher annual survival than those from the fire-maintained site (WEWO). Turtles experienced higher mortality during spring (Apr – Jun). Turtles at the burned site (WEWO) preferred mesic habitats such as hardwood forests, bottomlands, and streams, while avoiding upland longleaf forests. Turtles that used more fire-prone habitats experienced markedly higher mortality rates. Our initial results suggest turtles select areas that are less exposed to frequent intense fires while avoiding the more fire-prone xeric uplands, but whether this is a fire-avoidance mechanism or simply behavioral responses to other environmental factors is still in question. Further studies that assess the response of box turtles to fire over longer time-frames, or following experimental manipulations of fire regimes, would help land managers understand the implications of current management practices for non-target biota.

1194 - Role of hurricanes and drought in mortality of tidal forested wetlands using historical aerial photography

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The North Inlet-Winyah Bay estuary system has been subject to sea level rise for the past 6000 years resulting euhaline, mesohaline and oligohaline marshes and tidal freshwater forested wetlands distributed adjacent to the estuary. We have documented regression of the forest- marsh boundary along a small tributary to Winyah Bay that has accompanied sea level rise during the last 60 years. In that recession forest mortality appeared to be related to drought and low river flow. Why was drought more important than the surge caused by

Hurricane Hugo? To answer that question we used historical aerial photographs to examined forest mortality in three sections of Winyah Bay and North Inlet: one adjacent to euhaline marsh, one adjacent to mesohaline marsh, and one adjacent to oligohaline marsh. The rate of forest mortality and recovery differed by both topographic position and water source of the tidal surge. Adjacent to the euhaline marsh the surge caused widespread and immediate forest mortality in both wetlands and upland pines. Over the next 17 years vegetation patterns returned to near pre-hurricane conditions with a very small expansion of euhaline marsh. Adjacent to oligohaline marsh the surge was fresh water and caused minimal mortality and little change in vegetation pattern. However, over the next 17 years, during drought periods of the early 1990's and early 2000's, marsh moved into formerly forested wetlands. Adjacent to the mesohaline marsh the surge caused widespread mortality with only a partial recovery. The impact of storm surge and periodic drought had very different effects that depended on location in the estuarine system.

1198 - Investigating the reproductive outcomes of prolonged copulations in *Anasa tristis*

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Across insect taxa, copulation time can vary from 5 seconds to 7 days. In some insect species, longer copulations increase the amount of nutrition and/or sperm transferred to females, and can result in a female that lives longer, produces more eggs, and/or yields more offspring. However, such effects vary across species and are not easily predicted. We examined the effects of copulation duration using the squash bug (*Anasa tristis*), an insect with a promiscuous mating system and prolonged copulation durations. First, we determined the range of copulation durations for 24 pairs of insects. Copulations lasted from 2 min to 23.1 h, and first copulations were longer than second copulations (first: 8.0 ± 4.4 h; second: 2.0 ± 1.7 h; paired *t*-test: $t = 5.57$, df = 18, $P < 0.001$). To measure the effect of copulation duration on the number of eggs (fecundity) and offspring produced by females, and on how long females lived after copulating (longevity), we manipulated copulation duration for male-female pairs: pairs mated for 30 min, 2 h, 8 h, or an unlimited duration. Pairs each copulated once except for those that mated for unlimited durations; these pairs mated an unlimited number of times. Copulation duration did not affect female fecundity; results on how copulation duration affected number of offspring produced are forthcoming. Unexpectedly, we found that multiple copulations may decrease a female's longevity (Kaplan-Meier with log rank test: $P = 0.013$). We suggest that prolonged copulations may not benefit female reproductive success and may function in male mate guarding.

1201 - Tree Swallow roost-site selection in human-dominated landscapes

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For migratory organisms, studying the full annual cycle is necessary for understanding population dynamics and initiating conservation strategies. Tree Swallows are migratory songbirds that breed across much of northern North America in the summer, and many spend the winter along the Gulf Coast. They can be locally abundant, but are undergoing population declines in portions of their breeding range. Their breeding ecology has been studied for decades across many locations, but their winter ecology, including roosting behavior and habitat requirements, is not as well studied. This species forms enormous communal roosts in the winter across the Gulf Coast and inland, with some roosts containing several million individuals. We used historical Doppler weather radar to locate Tree Swallow roosts in southeastern Louisiana and central Florida from 1995 – 2012. We used software to label each roost, which provided information on the location, habitat, and consistency of each roost. In

Louisiana, autumn roosts were located mostly in sugarcane fields prior to the harvest, then moved to *Phragmites* beds along the coast until spring migration. In Florida, roosts were located in a variety of habitats, from coastal reed beds to phosphate clay settling ponds. In both areas, roost-site fidelity (both night-to-night and year-to-year) was high, even in Louisiana where the preferred roosting habitat forms a continuous landscape spanning several hundred thousand acres of land. We propose that such fidelity to roost locations may be an important driver of roost formation and maintenance, and that winter habitat and roost-site conservation has important implications for this species and others that roost communally in human-dominated landscapes.

1221 - Urbanization disrupts latitude size in 17-year cicadas

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Many ectotherms show a decrease in body size with increasing latitude due to changes in climate, a pattern termed converse Bergmann's rule. Urban conditions—particularly warmer temperatures and fragmented landscapes—may impose stresses on development that could disrupt these body size patterns. To test the impact of urbanization on development and latitudinal trends in body size, we launched a citizen science project to collect periodical cicadas (*Magicicada septendecim*) from across their latitudinal range during the 2013 emergence of Brood II. Periodical cicadas are long-lived insects whose distribution spans a broad latitudinal range covering both urban and rural habitats. We used a geometric morphometric approach to assess body size and developmental stress based on fluctuating asymmetry in wing shape. Body size of rural cicadas followed converse Bergmann's rule, but this pattern was disrupted in urban habitats. In the north, urban cicadas were larger than their rural counterparts, while southern populations showed little variation in body size between habitats. We detected no evidence of differences in developmental stress due to urbanization. To our knowledge, this is the first evidence that urbanization disrupts biogeographical trends in body size, and this pattern highlights how the effects of urbanization may differ over a species' range.

1222 - Temporal and Spatial Impacts of Hurricane Joaquin and Hurricane Matthew on Source and Drinking Water Quality

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Two intense rainfalls [Hurricane Joaquin (2015) and Hurricane Matthew (2016)], one year apart, provided a unique opportunity to examine changes in dissolved organic matter (DOM) dynamics in coastal blackwater rivers under extreme flooding conditions in the southeastern United States. Two sites along Waccamaw River (a coastal blackwater river) and the outflow of 18 sub-basins of Yadkin-Pee Dee Basin were sampled during and after the flooding events. The peaks of dissolved organic carbon (DOC) and nitrogen (DON) concentrations were observed 18 and 23 days after peak discharge in 2015 and 2016, respectively. Moreover, DOM aromaticity and abundance of humic substances significantly increased during the same period. Separation of discharge hydrograph into surface runoff and subsurface flow suggested that temporal changes were mainly due to contributions from subsurface flow flushing organic matter from wetlands and organic-rich riparian zones. The spatial analysis highlighted the key role of the forested wetlands as the only land use that significantly correlated with both DOM quantity (DOC and DON load) and DOM composition (i.e., aromaticity). The Yadkin-Pee Dee River basin alone exported more than 474 million kg DOC into the ocean during high-flow conditions from the 2016 event, indicating that such extreme short-term events mobilized enormous amounts of organic carbon and nitrogen to the ocean. Considering the predicted

increase in frequency and intensity of extreme rainfall events in the eastern U.S., the results of this study

1227 - Potential Benefits of Reforested Agricultural Riparian Zones for Bat Communities

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Bat conservation must occur in multiple habitats beyond national parks and protected forests if the ecosystem services bats provide are to be protected. This project contributes to our understanding of the efficacy of current conservation practices in mitigating bat habitat loss within agricultural settings. Current research suggests that restored riparian forests within an agricultural matrix may provide bat species with improved feeding opportunities and act as covered corridors between habitats. Our findings help inform stakeholders and government agencies as to the value of riparian forests established through the Conservation Reserve Enhancement Program (CREP) for promoting bats. Pettersson acoustic detectors were used to determine if CREP riparian zones (compared to control sites with denuded riparian areas) promoted increased bat diversity within the Shenandoah Valley of Virginia. The species richness and diversity of recorded bats were analyzed across treatments after classifying calls to species and one of three frequency guilds. Flying insects were collected throughout the field season using combined malaise and pan traps deployed simultaneously with the bat detectors. Insects were identified to Order with Coleoptera and Lepidoptera being identified to Family when possible. Transects, 100m x 10m, were established at each site and were surveyed for tree diversity, canopy cover, snag count, and DBH. Results were analyzed using statistics packages in 'R' to determine significance of CREP enrollment and specific characteristics of riparian buffers on bat activity. A trend of increased bat activity was observed across the three separate bat guilds as stand count increased. There was no clear distinction between sites enrolled in the CREP program and sites selected as controls, indicating that the number of trees present within a sampling area had a larger impact on the number of bat calls recorded than did enrollment in the CREP program and other aspects of CREP sites.

1249 - Ecosystem engineering by a native shrub in coastal grasslands

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Ecosystem engineers alter habitat, including temperature, air movement, water vapor, and biodiversity. State change from grassland to a shrub-dominated landscape has been documented globally for centuries. In many cases, encroaching woody species act as ecosystem engineers, impacting microclimate and overall functioning of the system, creating feedbacks that maintain the new vegetative state. State change on the Virginia barrier islands has occurred over the last 32 years with woody vegetation increasing by >40% into grassland. The nitrogen-fixing ecosystem engineer, *Morella cerifera,* alters the ecosystem through additional nutrient input, altered microclimates, and potential facilitative changes in species composition. Our objective was to quantify habitat changes and feedbacks associated with shrub expansion at the Virginia Coastal Reserve LTER site. Using species composition, canopy cover, transpiration, ground and air temperature, and water table depth we assessed ecosystem engineering across three zones: grassland, transition, and shrub thicket. We hypothesized that *M. cerifera* establishment drastically reduces biodiversity and maintains a moderated microenvironment that enhances productivity while altering depth to the water table. Growth of *M. cerifera* was rapid, increasing from ~70% to 85% cover in 3 years while reducing graminoid cover. Species composition was most diverse in transition plots, possibly due to enhanced N input; however, progression to full shrub thicket significantly reduced diversity. Increased shrub cover reduced extreme winter and summer temperatures. Shrub plots had less variability in temperatures while grassland did not show local microclimate

modification. Shrub cover increased transpiration and raised the water table locally, enhancing water availability to support the enhanced productivity that accompanies thicket development. The presence of shrubs impacts the local environment and alters ecological dynamics in otherwise nutrient poor coastal systems. The recent expansion of this ecosystem engineer has legacy consequences on community composition and may affect landscape level barrier island dynamics.

1255 - Temporal partitioning of foraging in *Plethodon metcalfi* suggests intraspecific competition for food.

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Between 1979 and 2007, observations of 2315 terrestrial plethodontid salamanders of five species were made at five forested sites within eight km of Highlands, NC in order to understand surface foraging patterns in leaf litter. Information concerning these salamanders included: species, snout-vent length (SVL), and observation time (minutes after sunset). Individual Plethodon metcalfi were identified as immature, adult males, or adult females. Of the five species of salamanders found at these sites (Plethodon metcalfi, Plethodon teyahalee, Plethodon serratus, Eurycea wilderae, Desmognathus ocoee), only Plethodon metcalfi (92% of all sightings) had enough observations to allow quantitative analysis of foraging. Immatures, females, and males of this species foraged at progressively later times after sunset, and these differences were significant. Immatures were divided into small (16–34 mm SVL) and large (35–49 mm SVL) size classes; foraging times became later with larger size. However, these differences were not significant. These data suggest that individuals of Plethodon metcalfi may partition the food resource temporally according to age and sex class. The exact nature of this limitation is, as yet, undetermined. Because Plethodon metcalfi is a member of a five-species guild on my study sites, investigation of food as a possible guild organizing factor is warranted.

1258 - Unexpected genetic diversity in polyploid *Isoetes* revealed with PacBio DNA sequencing

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Taxonomic boundaries between certain allopolyploid species of *Isoetes* of eastern North America are often muddled by their similar morphology. Next Generation DNA sequencing provides a technique for assigning individuals to species by phylogenetically clustering low-copy nuclear DNA sequences from each subgenome. By comparison with sequence data from diploid species of *Isoetes*, inferences can be made about the parentage of allopolyploid individuals. Individuals from multiple populations of tetraploid *I. appalachiana*, *I. hyemalis, I. louisianensis,* and *I. riparia* and hexaploid *I. boomii, I. georgiana*, and *I. microvela* were collected from the Southeast and a *LEAFY* intron sequenced using the PacBio RS II platform. These data indicate an unrecognized level of genetic diversity in polyploid *Isoetes*. While some populations are consistent with their traditional taxonomy, others show subgenomic combinations that do not match any described species. Genetically uniform populations occur most frequently, but some show a mixture of taxa and ongoing hybridization. The subgenomes in many polyploid individuals can be confidently assigned to a known diploid taxon, but several individuals contained genetically distant *LEAFY* sequences that suggest the existence of extinct or undiscovered diploid progenitors.

1269 - A Forty-Seven Year Comparison of the Vascular Flora at Three Abandoned Rice Fields, Georgetown, South Carolina

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The vascular flora present in three abandoned rice fields of the Winyah Bay Estuary at the Bell W. Baruch Institute for Marine Biology and Coastal Research, Georgetown County, South Carolina identified in 1968-1969 was compared with the vascular flora present in 1987-1991, and 2013-2015. Twenty vascular plant species were identified in 1968-1969 and 22 in 2013-2015 at the most saline marsh, Thousand Acre Rice Field. Forty seven taxa were reported at Airport Marsh in 1968-1969 and 27 in 2013-2015. Fifty six taxa were reported at Alderly Marsh in 1968-1969, while only 41 were identified here in 2013-2015. A parsimony algorithm was used to evaluate the distribution and co-occurrence of vascular brackish marsh species in 3 abandoned rice fields sampled at three intervals, 1968-1969, 1987-1991, and 2013- 2015. There was a shift in the flora at the two least saline sites, Alderly and Airport Marsh from 1968-69 to 1987-91 and 2013-2015. Three factors, rising sea level, an increase in water salinity plus the invasion of Phragmites australis may explain the shift in vegetation in Alderly and AirPort Marsh, the two least saline marshes. There was a shift in the flora at the most saline site, Thousand Acre Rice Field from 1967-1969 to 1987-1991 and 2013-2015 after the marsh was savaged by Hurricane Hugo in 1989. The invasion of non-native Phragmites australis at all sites and the increase in water salinity at all sites best explains the reduction in vascular plant species at Airport and Alderly marshes over the 47 year collecting period.

1279 - Utilizing Digital Data from Natural History Collections for Conservation and Education Applications

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Natural history collections are one of the richest sources of information for documenting biodiversity on our planet but have been underutilized as a data resource outside of the museum community. Thanks to efforts like the NSF's Advancing Digitization for Biological Collections Program and iDigBio, over 100 million specimen records are now freely available through the iDigBio Portal. Now that data mobilization is underway, collections are beginning to shift focus to expanding data use and reaching out to ecologists, conservation biologists, genomic researchers, and others to increase awareness of the vast resource that collections offer. It is also crucial that we focus on training the new generation of scientists to be able to use big data resources like collections data. iDigBio is working together with numerous partners to create resources to enable data use in both research and education. Resources to be discussed include tools for utilizing the iDigBio portal in conservation and research, suggested activities for undergraduate and K-12 education, and available webinar productions.

1283 - Habitat and Seasonal Preferences of Fiddler Crabs across Gulf Coast Tidal Marsh Vegetation Zones

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Interspecific facilitation influences tidal marsh structure and function by ameliorating stress, thus filling an important role in estuarine ecosystems. Research in salt marshes dominated by the grass *Spartina alterniflora* indicates that plant characteristics affect fiddler crab burrowing and in turn, crab activity can enhance primary productivity by increasing soil oxygen and nutrient cycling. Crab-plant interactions have not been well studied in microtidal Gulf Coast marshes where *S. alterniflora* is restricted to a narrow band along the low intertidal zone, the

rush *Juncus roemerianus* forms the most extensive vegetation zone, which grades upslope into a narrow fresh marsh, and hypersaline salt pannes are patchily distributed. It is unknown how structure of these dominant vegetation zones affects density of crab burrows and how burrows may influence primary productivity. We hypothesized that fiddler crabs would be most abundant in marsh zones with intermediate substrate hardness and vegetation density (Goldilocks Hypothesis). To determine fiddler crab usage of these zones, we conducted a seasonal habitat preference study in tidal marshes at Grand Bay National Estuarine Research Reserve in coastal Mississippi using burrow density as a proxy for crab abundance. We also sampled plant above- and below-ground biomass, burrow proximity to vegetation and soil hardness as potential drivers of fiddler crab populations. Our results indicated that fiddler crabs burrow in all four zones, but to varying degrees and that burrow density was highest during our autumn survey. The fresh marsh had the highest average density of burrows as well as vegetation and soil parameters most representative of intermediate habitat, thereby supporting our hypothesis. The brackish marsh also proved to be important fiddler crab habitat. Preferential fiddler crab usage of upslope habitat like fresh and brackish marsh in our Gulf Coast sites suggests that transitions to higher elevations with sea level rise may be relatively smooth.

1304 - Response of a South Carolina Coastal Freshwater Forested Wetland to Extreme Weather Events

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Coastal freshwater forested wetlands in South Carolina have experienced a number of extreme weather events in the past three years (Hurricane Joaquin in 2015, Hurricane Matthew in 2016, and Hurricane Irma in 2017). The track of these storms impacted a long-term research site on Hobcaw Barony, providing the ability to compare the impacts of differing storm intensities on community structure and health of that system. Strawberry Swamp discharges into the Winyah Bay estuary. Forests in the swamp range from seasonally to permanently flooded swamp containing baldcypress (*Taxodium distichum* [L.] Rich.), water tupelo (*Nyssa aquatica* L.), and swamp blackgum (*Nyssa biflora* Walt.) with an understory mainly of waxmyrtle (*Morella cerifera* [L.] Small). There is a salinity gradient in existence within the watershed, ranging from 1 ppt in the upper reaches to approximately 5 ppt in the lower reaches. Water depth is dynamic and responsive, driven by precipitation events that cause water depths to spike after rainfall events. No tree mortality occurred as a result of the storm events, but there were varied differences in leaf litter production and tree growth from each event. Continued study of this site will allow us to track the response of different tree species and overall forest communities before and after hurricanes impact an area, and allow us to contrast how the forest communities change through time with and without hurricane disturbance.

1316 - A new *Habranthus* species (Amaryllidaceae) endemic to Mexico City

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A new white-flowered *Habranthus* (Amaryllidaceae) with 2n = ca. 96 has been discovered in the pedregal of Mexico City. At first glance in the field it might seem to be *H. concolor* Lindl. (2n = 22); however, it is the only white-flowered Mexican *Habranthus* with its stigma among or very near the top of the anthers (an indicator of self-pollination and polyploidy) and not well-beyond the anthers. A key to Mexican *Habranthus* species is presented.

1335 - The Vascular Flora of Orchard Knob: A Peephole into the Historical Limestone Glades of Chattanooga, Tennessee

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Orchard Knob Reservation, a branch of the Chickamauga and Chattanooga National Military Park only minutes from downtown Chattanooga, houses a rich and unique flora. So far, 105 species (representing 86 genera and 42 families) have been collected from this 2-acre area, including a small population of *Clematis fremontii*, an S1 species in Tennessee. In this study, along with a floristic survey of the site, we explore the area's botanical history using Civil War-era herbarium specimens and historical documents, including letters written between botanists Gattinger and Engelmann. Additionally, we predict and map the locations of historical limestone glades in the greater Chattanooga area through the use of herbarium specimens of select glade-indicator species.

1354 - Breeding Bird and Herpetofaunal Response to Fire Severity, Repeated Burning, and Mechanical Fuel Reduction In Hardwood Forest

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We experimentally assessed how breeding birds, reptiles, and amphibians responded to untreated controls (C) and three repeated fuel reduction treatments (n=3; 2001-2016): (1) mechanical understory removal (twice) (M); (2) winter prescribed burning (4 times) (B); or (3) mechanical understory removal followed a year later by a high-severity prescribed burn and 3 subsequent burns (MB). Initial (2003) high-severity fires in MB created open-canopy structure with abundant snags. In B, where initial burns were lower-intensity, modest delayed tree mortality resulted in a "perforated," canopy structure with more gaps and snags. In MB, breeding bird species richness and density increased within 3 breeding seasons after initial high-severity burns, and remained high after repeated burns, compared to other treatments. In B, bird abundance and richness was similar to C after repeated burns, but several additional species associated with open-forest conditions occurred at low levels. Burning temporarily reduced habitat suitability for ground-nesting birds. Overall, bird communities in M were similar to C, as shrubs recovered rapidly. Total amphibians, total salamanders, total anurans, and the 4 amphibian species tested, were not affected by any fuel reduction treatment. Total lizards were more abundant in MB. *Plestiodon fasciatus* were more abundant in MB than B or C, and *Scleroporus undulatus* were more abundant in M and B than C. Our results indicate that high-severity fires can create young forest conditions that may be prolonged by subsequent low-intensity burns (MB). Repeated low-intensity burning (B) may eventually promote a more heterogeneous canopy structure through delayed tree mortality and attract some disturbance-adapted breeding bird species. Different responses among species highlights the importance of including multiple taxa when assessing impacts of forest disturbances on wildlife, and gives perspective on how forest "health" may vary depending on target taxa.

1369 - Findings of Undergraduate Students Conducting Ecological Surveys in the BIBB County Glades "Botanical Lost World."

Joshua Fuller, Thomas Diggs, Evan Lampert

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Wildlife populations continue to decline; it is imperative that sensitive populations are continually monitored, but there are not enough qualified individuals for this. We designed a three-week summer course, first taught in 2016 and continuing to the present, titled "Plant and Animal Interactions" with all three authors involved in the course (two are teachers, Dr. Evan Lampert and Dr. James Diggs, and one was a student, Joshua Fuller). The goal of PAI is to teach undergraduates how to observe and measure the interspecific interactions between populations of plants and animals, specifically Arthropods (insects and their relatives), and how they change across ecotones. Undergraduates are trained in the collection and identification of insects and plants. Students are taught how to lay out transect lines, set up quadrats, and how to identify herbivory patterns. The 2016-17 classes featured a trip to The Kathy Stiles Freeland Bibb County Glades Preserve in Bibb County, Alabama, a plant biodiversity hot spot with eight endemic plant taxa and 60 plant taxa of conservation concern, to practice all field techniques learned. Over 3,000 observations of interactions between arthropods and plants were produced by the undergraduate students. Based on reflections written by the students at the end of the course, they became more confident with field work and possessed a greater interest in the natural sciences. A principle components analysis was performed across 13 herbivory patterns for the 2016-17 class data, and suggests that herbivory types show a stronger association with plant traits than ecosystem type.

1380 - Development of an Avian Index of Biological Integrity for Kentucky Wetlands

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Bird communities are frequently used as bioindicators to assess environmental conditions, including in wetland habitats. We developed an avian index of biological integrity (IBI) for wetlands of Kentucky as an intensive assessment method to supplement an existing rapid assessment method used in regulatory programs. Birds are useful indicators because they are sensitive to environmental changes, abundant in various landscapes, occupy higher trophic levels, and can be sampled in a cost-effective manner. Breeding bird point count data from 103 sites were used to calculate a set of 49 avian community metrics. Avian metrics were tested for correlation with independent landscape, hydrology and habitat measures of wetland condition. High performing, non-repetitive metrics were tested using a model averaging approach to find the best set of avian community metrics that predicted an independent measure of wetland condition. Final metrics were scaled and assembled into an Avian IBI. We found four superior metrics to be significantly related to the independent disturbance index. The final metrics used to create the Avian IBI were percent presence of insectivores, percent presence of ground gleaners, percent presence of residents and Shannon Wiener Diversity Index. Both Shannon Wiener Diversity Index and percent presence of insectivores decreased with increasing disturbance. Percent presence of ground gleaners and percent presence of residents had a positive relationship to disturbance. Previous studies found similar results with insectivorous guilds being intolerant to human disturbance, whereas ground-gleaning guilds tend to be more tolerant. This cost-effective and time-efficient IBI complements existing assessment tools for wetlands of Kentucky.

1394 - Integrative taxonomic studies of the *Viola edulis* complex

Harvey Ballard, Alex Greff

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In 1817, Stephen Elliott published Viola palmata L. var. heterophylla from the Ogeechee River bottomlands near Savannah, Georgia, one of the earliest lobed-leaved violets described from North America. Since then, other morphologically similar violets have been described from riparian bottomlands along the Atlantic and Gulf Coastal Plains. Although the complex as a whole has been synonymized with other taxa, dismissed as hybrids, maintained as a variety,

or recognized as one or more species, the complex has never received comprehensive attention. An integrative taxonomic study has been initiated using materials and observations from field and herbarium studies, and common garden observations. The Unified Species or General Lineage concept is being applied objectively to evidence from macromorphology, micromorphology, microsatellite marker diversity and geographic distribution. Although preliminary thus far, results urge recognition of four to five partially allopatric evolutionary species along the Atlantic and Gulf Coastal Plains. These are V. atlantifluminis sp. nov., from the DelMarVa peninsula to South Carolina; V. edulis Elliott ex Spach (probably conspecific with and predating V. chalcosperma Brainerd), from South Carolina to Florida; V. eduloides sp. nov., from Florida to Mississippi; and V. pedatiloba (Brainerd) H.E.Ballard, comb. nov., from Mississippi to Texas.

1395 - Music and karaoke videos: teaching tools for biology/ecology/evolution.

Gary Grossman

University of Georgia, Athens, GA

Since 2012 I have used music as a pedagogical method in ecology classes. I began by writing and performing songs based on class materials including concepts, habitats, and species' biology and posting these videos on the web. This led to production of an ecology/evolution CD entitled Natural Voices www.garygrossman.net/natural-voices/. Questionnaire results indicated that the music videos significantly improved attitudes towards class and studying. I transformed this exercise into one involving active learning by having students make their own karaoke video. Students had to write the lyrics and sing/rap them but could use video and music from the web for their videos. I have used the videos in six undergraduate and two graduate classes and evaluated effectiveness via 10-14 question, Likert-scale questionnaires and triangulation interviews. Undergraduate classes were dominated by non-science majors in their first or second year. Questionnaire responses and triangulation interviews indicated that students had strong positive reactions to the project and there were significantly more positive responses to questionnaire questions than negative responses. Students did not demonstrate a preference for the different parts of the exercise (e.g., writing lyrics, research, singing, etc.). There was a significant difference in the number of positive responses from students with low, average and high levels of musical experience, but student's majors had no effect on their responses. Triangulation interviews from students in all classes were strongly positive and a simple trend analysis indicated that many students found the exercise was: 1) new, 2) creative, 3) facilitated deeper learning, and 4) was enjoyable. Studies that evaluate inquiry-based classroom exercises over multiple classes and university levels are uncommon, and this is one of the first to show strong positive student responses to an inquiry-based, music-based exercise over courses ranging from first-year to graduate seminars.

1396 - Use of Fitness-Based Habitat Selection Studies for Drift-Feeding Stream Fishes

Gary Grossman

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The study of habitat selection is crucial to our understanding of how freshwater organisms utilize space. Nonetheless, most habitat selection studies involve correlations between physical habitat measurements and fish abundance rather than on quantified relationships between fitness and habitat. In several earlier papers we developed a fitness-based microhabitat selection model, built on relationships between stream velocity and foraging success. These data were used to predict holding positions that maximized net energy gain for Rainbow Trout and four species of drift-feeding minnows in a North Carolina stream. The model successfully predicted optimal holding velocities in 11 of 14 cases. To evaluate the robustness of the model we tested it using two species of Alaskan drift-feeding fishes: juvenile Chinook Salmon (*Oncorhynchus tshawytscha*) and Arctic Grayling (*Thymallus arcticus*). The

model successfully predicted optimal holding velocity for Arctic Grayling in one stream but not in another. In addition, the model failed to predict optimal holding velocities for juvenile Chinook Salmon. The most likely explanation for failure of the model is that predation pressure was significant in both streams where model failure occurred. Alternatively, failure for Arctic Grayling in one stream occurred in a stream that was shallow and highly turbulent, which made measurements of holding velocity difficult. Regardless, fitness-based models will enable us to directly quantify habitat quality rather than rely on indirect measures and assumed relationships.

1397 - Morphological and Physiological Comparisons between Yellow Toadflax (*Linaria vulgaris*) Individuals in relation to Auxin Concentrations of Indole-3-Acetic Acid (IAA) and 2,4-Dichlorophenoxyacetic Acid (2,4-D)

Alexander Allmon

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Current management strategies for the containment of the invasive plant populations of yellow toadflax using auxin-based herbicides have been known to induce evolutionary modifications within the plant species. For the past three years, several 20-week block experiments were conducted throughout the various growth stages (2-week intervals) of yellow toadflax's first-year life cycle. Individuals were grown from seed under greenhouse conditions and treated with a single application of 2,4-D at a concentration of 3.6% during one of the predetermined stages. Collections of data regarding growth rates between soil-only applications, shoot-only applications, and untreated individuals were then documented. Additionally, individuals were either grown in loamy or sandy soil-types as a matter of collecting comparative measurements in plant growth, IAA production, and herbicide absorption, degradation and/or leaching potential. Our results have successfully demonstrated that the yellow toadflax species has the ability to withstand various 2,4-D applications (64% survivability), and 75% of the treatment-surviving individuals were asexual produced sucker shoots (ramets). The auxin-based herbicide treatments appear to promote an increase in asexual, vegetative reproduction through root budding compared to the majority of untreated, yellow toadflax individuals which focused on sexual reproduction via flowering. Using liquid chromatography and mass spectrometry (LC-MS) analysis, molecular measurements in auxin concentrations, such as IAA and 2,4-D, may become beneficial for providing physiological data on the morphological changes of the yellow toadflax species within herbicide-exposed or unexposed environments.

1401 - Invasive Asian clam, *Corbicula fluminea*, Impacts on the Indigenous Benthic Community

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The Asian clam, *Corbicula fluminea*, is a nonindigenous aquatic species that many have long considered to have a negative competitive effect on the balance indigenous community (BIP). This has been attributed to extremely high densities reached by invading Asian clams. Unfortunately, few studies have addressed direct impacts of Asian clams on the native benthic community. This study examines the impact of Asian clam establishment on the BIP using several community metrics to compare before/after clam arrival, and to compare upstream sites lacking Asian clams to downstream sites with Asian clams in the Merrimack River, NH. For sites or years where Asian clams were present, Asian clams were excluded from metric calculations for equitable comparison of communities. Total invertebrate density, invertebrate taxa richness, EPT taxa richness, Shannon Diversity, and Hilsenhoff Biotic Index (HBI) did not differ significantly, or differed significantly toward improvement, among upstream sites without Asian clams compared to downstream sites with Asian clams. Similarly, none of these metrics differed significantly, or there was a significant improvement, comparing years prior to Asian

clam establishment (1972 and 1973) to years following Asian clam establishment (2011,2014, and 2016). For 2014 data, cluster analysis using Bray-Curtis similarities failed to separate Asian clam sites from sites without Asian clams. Native bivalve abundances and size distributions were not affected by Asian clam presence. Contrary to previous claims, taken together, these before/after and presence/absence community metric comparisons indicate Asian clams do not negatively impact, or may even have a positive effect, on the BIP.

1407 - The Use Of Herbarium Specimens In Distribution And Dispersal Modeling And Conservation Planning: The Answer Is Blowing In The Wind.

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We coupled available specimen locality data from the SERNEC portal with US Forest Inventory Analysis data since 1979 to develop a robust data set for use in Species Distribution and Seed Dispersal Modeling. The Southeastern endemic tree species, Gordonia lasianthus, may serve as a surrogate for less common species in the region that exhibit anemochorous seed dispersal patterns. The number of available records of G. lasianthus in the SERNEC portal has increased eightfold over the past four years (2014-2018), and these data suggest that its range may be larger than previously understood (approaching the eastern border of Louisiana and possibly entering Virginia to the North). In addition to the use of occurrence data, physical specimens and specimen images were scrutinized for the timing of phenological events (namely fruiting) to establish a time frame for potential dispersal opportunities. Twenty seeds were extracted from the fruits of one specimen at the A. C. Moore Herbarium at the University of South Carolina (USCH) and used in seed drop trials to determine terminal velocities as a means of calculating maximum dispersal distance. Freshly collected ripe fruits (recently dehisced) were subjected to controlled humidity conditions using saturated salt solutions to determine the maximum relative humidity (RH) below which capsules would remain open. Using weather data from the North American Regional Reanalysis (NARR 1979-2017) and the European Centre for Medium-Range Weather Forecasts (ECMWF ERA-20C 1900-2010), we constructed a model to record prevailing wind directions and velocities during potential dispersal conditions (i.e. October through March during times of day when RH was below 67%) across the Northern (inland) and the Southern (peninsular Florida) range boundaries. Results indicate that winds during the seed season under these conditions typically blow into the existing range along the northern boundary thereby limiting northward expansion and suggest a possible evolutionary trap.

1427 - The effects of various pathogens on cortisol levels of *Danio rerio* measured from holding water compared to full body collection

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Zebrafish serve as a reliable model for research in both anxiety and immunology due to the similarity in their stress-regulating (HPA) axis and their immune system in comparison to mammals. Previous studies have focused on the impact stress has on the immune system, but there has been less focus on the effect an immune response has on the HPA axis. In order to measure an expected increase in cortisol in response to a panel of different pathogens, a pilot study was first conducted to determine the best method for collecting cortisol from zebrafish. The first method used a noninvasive technique to collect cortisol from the holding water of zebrafish before and after exposure to a pathogen. The second method used the full body of the fish to extract cortisol through tissue homogenization. Concentration of samples was determined using an ELISA. Statistically significant conclusions cannot be made about the effects of various pathogens on the cortisol levels of zebrafish, but it was determined that the

full body collection was superior; further research should use this method to investigate the stress response of zebrafish after exposure to different pathogens.

1429 - Assessment of Expert Decisions on Non-Native, Conifer-Specialist Insect Impacts in North America

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Non-native insects often have an impact on the environment in which they are introduced. Insects that cause moderate to severe impacts on their introduced environments may become the focus of risk assessment and management decisions. Severity of impact varies depending on perspective, but can be determined through interpretation of the work of experts who have researched specific non-native, invasive insects. Occasionally, scientists do not clearly define the impact, are uncertain about impact, or cannot agree on the impact or potential impact of an insect invader. This vagueness, uncertainty, and disagreement may affect the decision-making and management process, since it makes it difficult to accurately determine the current and predicted impacts of the insect. For this study, we aimed to: 1) evaluate consensus on impact assessments of 41 non-native, conifer-specialist insects; 2) assess correlations among their prior level of expertise, scores for insect impact, and level of uncertainty about their impact score; and 3) isolate the source of divergence for insects with highly divergent impact scores. We had 15 scientists each evaluate the impact of non-native, conifer-specialist insects, so each insect was assessed four times. Scientists also provided their level of expertise and level of uncertainty for each insect that they assessed. Of the 41 insects that were assessed, scientists completely agreed on 11 (27%), including the high-impact hemlock woolly adelgid (*Adelges tsugae*) and three low-impact species of pine needle aphids. We found a negative correlation between level of expertise and level of uncertainty, and a positive correlation between level of expertise and impact score. Variance in assessment peaked in insects with a moderate impact level. Overall, prior perceptions of an insect and vagueness in research publications can lead to different interpretations of impact among experts, which can have lasting implications for decision-making and resource allocation concerning management of invasive insects.

1435 - Fitness Consequences of Genetic Variation in Wolbachia Infected Wasps

Sarah Killeen

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Wolbachia pipientis is an intercellular bacterium found in arthropods and some species of nematodes. *W. pipientis* is a selfish genetic element and can manipulate reproduction to ensure its spread into a population. Along with this manipulation, *W. pipientis* can also reduce the fitness of a population, due to its parasitic nature within most arthropod populations. The main goal of this experiment was to determine *if W. pipientis* reduces fitness, and if *W. pipientis* reduces fitness and a greater or lesser margin when coupled with genetic variation. Fitness was measured from four different experiment groups of *Trichogramma kaykai* cultures. The *T. kaykai* cultures came from LC13 and SW183 lines, and the fitness of the F1 generation was observed in this experiment. Fitness was measured in terms of reproductive fitness and survival fitness in all experiment groups. Overall it was found the *W. pipientis* negatively impacts both reproductive fitness and survival fitness. When *W. pipientis* is coupled with genetic variation, the fitness cost decreases, but not at a high margin. The data gathered in this experiment shows that *W. pipientis* negatively impacts fitness in the F1 generation, but further observations were made after this generation in the F2 generation. So this experiment has been continued to discover how *W. pipientis* impacts further generation and how *W. pipientis* when coupled with genetic variation impacts fitness of further generations as well.

1441 - Ecology of aquatic larvae in the contact zone between two cryptic, parapatric salamander species

Carlos Camp, Emily Benfield, Jenine Brideau, Stephen Owensby, Keelan Passmore, Jessica Smith, Rajvee Vajani, Jessica Wooten

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Parapatric distributions between similar species may be the result of interspecific competition, differential adaptation to variation in the abiotic environment, or a combination of the two. The Blue Ridge Two-lined Salamander (*Eurycea wilderae*) and the Southern Two-lined Salamander (*E. cirrigera*) are parapatrically distributed in the southeastern US, where they occur in the southern Appalachians and adjacent Piedmont, respectively. The larval stage represents a significant component of the lifespan of these biphasic species, lasting from one to two years. Larvae of both species can occur in very high densities (>100 m^{-2}), and they are extremely similar in both morphology and ecology. The two species occur together along a narrow zone in the Appalachian foothills. We tested whether interspecific competition and/or adaptation to different abiotic regimes is present in the larval stage. We specifically tested for food partitioning and character displacement as signals of competition. We further tested for differences in thermal preference as a surrogate measure of differential adaptation to the abiotic environment. We found no evidence of either competition or differences in thermal preference in the larvae of these salamanders. Therefore, we conclude that the operative mechanism maintaining parapatry between these species occurs in the adult stage.

1448 - Biotic and abiotic impacts of chronic acid mine drainage in Dunkard Creek (Greene County)

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Dunkard Creek is a third-order stream that drains 76.2 square miles, weaving thirty-seven miles through Greene County (PA) and Monongalia County (WV) before emptying into the Monongahela River. Prior to an massive discharge of mining-associated brine in 2009, Dunkard Creek displayed exceptional aquatic biodiversity, including trout, mudpuppies, pollution-sensitive macroinvertebrates, and more than a dozen species of freshwater mussels (including two federally listed species). While restoration efforts are underway, the lower three miles of the stream remain permanently impaired by acid mine drainage. The aims of our study were 1) to assess recovery in Greene County portions of the stream and 2) to compare the ecological communities found in recovered and impaired reaches of the stream. Between May 1st and October 1st of 2017, we performed monthly surveys of three sites chosen to represent a gradient of environmental impact (no site could be called “pristine”). Water chemistry testing included: pH, iron, nitrates, nitrites and hardness. We also performed replicated macroinvertebrate collections and surveys of weathered dead freshwater mussel shells. Fish communities were sampled once at each site. Shannon-Wiener diversity index values were negatively associated with acid mine drainage. Bray-Curtis dissimilarity values revealed site 1 (the most pristine) to be dissimilar to sites 2 and 3 (0.424 and 0.431 respectively), whereas sites 2 and 3 were much more similar (0.145). While community recovery is apparent upstream, continual impairment of the lower reaches of Dunkard Creek remain depauperate in both organismal abundance and diversity, and no live freshwater mussels were found at any site.

1452 - Plants versus salamanders: the effects of competition on spotted salamander and bladderwort life history

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The coexistence of organisms in nature is more likely when phenotypic similarities of individuals are reduced. Despite the lack of similarity, distantly related taxa will compete intensely for shared resources. No larger difference between organisms that share a common prey could exist than between carnivorous plants and animals. However, few studies have considered inter-Kingdom competition among carnivorous plants and animals. In order to evaluate interactions between a carnivorous plant (common bladderwort, Utricularia macrorhiza) and a vertebrate (larval spotted salamanders, Ambystoma maculatum), we conducted a mesocosm experiment. We deployed two levels of spotted salamander density and the presence/absence of bladderwort. We measured salamander survival and growth along with bladderwort growth and flowering time. Mean spotted salamander survival and size at metamorphosis was not affected by the presence of bladderwort. However, mean time to metamorphosis was significantly increased in the presence of bladderwort. Mean bladderwort flowering time was delayed with an increase in spotted salamander density, but growth was not affected. Our data suggests that competitive interactions between carnivorous plants and larval spotted salamanders affect some key life history traits (time to metamorphosis and flowering date), but not others (growth or survival). Therefore, these interactions may be context dependent on resource availability with indirect costs survival or future fitness. Overall, our work illustrates that aquatic carnivorous plants may have unexpected impacts on other species in wetland food webs.

1455 - First-year vegetation responses to fall wildfire in Southern Appalachian forests

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In concert with climate warming, episodic fire and drought could push Southern Appalachian forests toward warmer, drier systems and more fire-tolerant vegetation. To begin testing this hypothesis, we monitored post-fire groundlayer and seedbank composition, phenology, and soil CO_2 efflux in burned (B) and unburned (U) areas of two mid-elevation sites (WS, CS) that experienced low to moderate intensity fall wildfires. Fire decreased the litter layer in both sites. Ground-level air temperature did not differ between B and U plots, but spring and summer soil temperatures were higher in B plots. Lower soil CO_2 efflux and less increase with temperature suggest litter limitation, reduced microbial activity, or less root growth in burned plots through midsummer. Canopy openness and vegetation cover did not differ between B and U plots at WS, but more seedlings germinated from B seedbanks. Canopy openness and the number of germinated seedlings were greater, but vegetation cover was lower, on B plots at CS. Neither diversity nor duration of flowering and fruiting differed between B and U plots at WS. Overall, fire led to warmer soil, decreased litter inputs for soil respiration, and increased regeneration from the seedbank, but caused little initial change in extant vegetation.

1459 - A Short-Term Temporal Meta-Barcoding Survey of Planktonic Protists in Appalachia - Natural Tunnel State Park, Virginia

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The purpose of this study was to survey freshwater planktonic protists in an under-sampled region of Appalachia, and address three questions: How diverse is the eukaryotic microbiome? Is that microbiome temporally dynamic? What abiotic factors affect changes? Water samples were collected from the Natural Tunnel State Park in Scott County, Virginia (USA) over fourteen weeks and barcodes from 23S and 18S rRNA regions were sequenced, identifying 3663 OTUs representing 213 families and 332 genera. The greatest diversity was found in P:Chlorophyta and P:Intramacronucleata and the greatest abundance in P:Bacillariophyta and P:Cryptophyta. The five sites had distinctive protist profiles primarilty defined by the

photoautotrophs. Temporal analyses demonstrated these profiles changed dramatically during the study period and each area's microbiome was distinct for short periods of time. Despite the changes in taxa, the proportion of abundant versus rare protists remained steady between time points suggesting there are limited numbers of microbial niches in the systems we surveyed and the rare microbial biome quickly fills vacated niches. The rapid changes in protist populations are likely due to micro-climate or -environmental effects but we were unable to identify a single contributing factor. Instead there appears to be interplay between multiple factors with collection date, phosphate concentration, ammonia concentration, and conductivity having the greatest influence.

1461 - Circularization of *Chlamydomonas reinhardtii* mitochondrial mRNAs place ribosomal binding sites upstream of leaderless transcripts

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The mitochondrial genome of *Chlamydomonas reinhardtii* encodes eight protein coding genes transcribed on two poly-coding primary transcripts. The individual mRNAs are endonucleolytically cleaved from these transcripts directly adjacent to their AUG start codons leaving them leaderless. Within the genome, ribosome binding sites (RBS) occur upstream of each start codon but the 5' maturation separates them from these start codons, leaving them in the 3' untranslated region of the coding region immediately upstream. In this study, we demonstrate that exonucleolytically processed mRNAs are circularized, bringing together the 3' and 5' termini. This places a RBS upstream of the start codon of each mRNA and removes the need for an alternative translation initiation mechanism. Sequencing of the circularized mRNAs found a portion of the mRNAs included poly(C) rich 3' termini joined to the mature 5' AUG of most mRNAs. These poly(C) tails may protect against or slow down exonucleolytic digestion so mRNAs can be circularized and translated. These data provide evidence of a new organellar RNA processing mechanism and mechanism explaining the purpose of circularized RNAs in these mitochondria.

1472 - The effects of *Wolbachia* bacterium on the *Trichogramma* populations

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Trichogramma is a genus of parasitic wasps, of which some species are infected by the intracellular bacterium *Wolbachia pipientis. Wolbachia* is a reproductive parasite among *Trichogramma* species and has the evolutionary potential to trap host species in an obligate host-parasite relationship. Parthenogenesis-inducing *Wolbachia* found in many *Trichogramma* species often results in the loss of female sexual function and the dependence of infected hosts on *Wolbachia* for reproductive fitness. The research presented here is the continuation of experimental evolution in a host-*Wolbachia* symbiosis found in the species *Trichogramma kaykai.* Established experimental populations of infected and cured wasps have been maintained with and without genetic variation, testing the effects of obligate parthenogenesis. Initial results suggest heterozygosity and recombination have significant fitness consequences for both infected and cured populations. These results were used as a baseline for later generational fitness comparisons investigating the longer term impact of genetic variation and the role cryptic sexual selection may play in the loss of female sexual function.

1499 - The Role of Myeloid NF-κB in Glioblastoma

Jennifer Bradford

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Glioblastoma (GBM) is the most aggressive form of brain cancer and is the most common adult subtype. GBM patients typically only live an average of 15 months after diagnosis, which is due in part to GBM's high rate of resistance to standard therapies. Many cancers, including GBM, consist of malignant tumor cells as well as supporting, non-cancerous, cells that make up the tumor stroma. Tumor-associated macrophages, a critical component of the tumor stroma, can be present in very large numbers in a variety of cancers, and can lead to tumor progression through promotion of tumor inflammation, angiogenesis, invasion, and metastasis. Canonical nuclear factor-kappaB (NF-κB) pathway activity is very important in normal immune function, synaptic plasticity, and memory, and aberrant NF-κB activity is associated with autoimmune disease, and importantly, cancer. Previous studies have been reported about the importance of tumor cell associated NF-κB signaling in cancers. As myeloid cell NF-κB signaling may also be important in promoting cancers, we have been utilizing a $p65^{fl/fl}$/LysMCre transgenic animal model, which lacks p65 protein in cells of the myeloid lineage to study the impact of myeloid cell derived NF-κB signaling in GBM. This transgenic model has very efficient deletion of p65 protein in bone marrow derived macrophages, but brain residing microglia do not have significantly lower p65 levels as compared to control microglia. Even with this finding, $p65^{fl/fl}$/LysMCre mice implanted with syngeneic GBM cells have significantly reduced GBM tumor burden than LysMCre control mice, as measured by magnetic resonance imaging. This result underscores the potential importance of bone marrow cells that migrate to the tumor site and significantly contribute to GBM growth. This work also indicates the potential benefits of targeting myeloid specific NF-κB signaling in GBM patients.

1501 - Using deep learning to classify animal venom proteins.

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Animals of numerous phyla have evolved venom of greatly varied toxicity and specificity. Symptoms of envenomation in humans include intense pain, numbness, and blurred vision in the case of scorpions, black widow spiders, cone snails and coral snakes, as well as necrosis in the case of brown recluse spiders and rattlesnakes. Venoms are a cocktail of biomolecules consisting of inorganic salts, polyamines, and thousands of proteins with varying molecular targets ranging from hemotoxins, cytotoxins, myotoxins, necrotoxins, and neurotoxins. Determining the biological function and efficacy of protein sequences in the absence of biological data has remained a nontrivial task in bioinformatics. Here we describe a method to distinguish toxic proteins from their non-toxic homologues. We trained a deep neural network with four hidden layers and a deep random forest model with verified protein sequences from UniProt as training data. Our deep learning framework was able to accurately identify venom proteins from snakes, spiders, cone snails as well as robber flies that were not included in the original training dataset, thus demonstrating the extensibility of our method. This tool is freely available online and will hopefully be further utilized to elucidate broader patterns of molecular evolution involved in the convergent evolution of venom proteins in animals.

1505 - Seagrasses in Transition

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Increasing anthropogenic pressures and large-scale changes in ocean systems due to climate change pose a great threat to coastal ecosystems. In North Carolina, seagrass meadows consist of monospecific stands of temperate *Zostera marina* or mixed meadows containing *Z. marina*, sub-tropical *Halodule wrightii,* and/or eurythermal *Ruppia maritima*. In mixed meadows, dominance is divided temporally, with *Z. marina* most abundant (density, cover and

biomass) during the late spring and early summer and *H. wrightii* increasing after summer daily mean water temperatures increase to ≥ 28 °C. As summer water temperatures continue to increase due to climate change and species-specific thermal limits occur earlier in the year, *Z. marina* is predicted to decline and *H. wrightii* and *R. maritima* are expected to increase in abundance. While seagrass meadows in NC may persist without *Z. marina,* it is unclear if the loss of a species will significantly increase their vulnerability to future perturbations and reduce ecological functions, as even morphologically similar foundation species can differ in key characteristics that influence resilience and ecological function. The research presented here quantifies how large-scale shifts in the community structure of foundation species affects the persistence of seagrass meadows by linking changes in genetic and species diversity to ecosystem resilience at the transition zone between temperate and sub-tropical seagrass regions. Through field observations and molecular analyses, we quantified changes in species-specific structural (biomass, density, % cover), physiological (productivity) and resilience (genetic diversity, seed bank viability) indicators to changing abiotic conditions (temperature °C and light (PAR µmol $m^{-2}s^{-1}$) at 3 sites in southeastern NC. We conclude that further understanding of the mechanisms that drive ecosystem resilience and quantification of how geographic range shifts of foundation species predicate large-scale changes in ecosystem functions of coastal marine ecosystems is vital to accurately forecast the response of marine ecosystems to future stressors.

1513 - The seed germination ecology of *Gentiana flavida*, an endangered species in Kentucky.

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Gentiana flavida is an endangered species in Kentucky, with populations known from only five counties. The purpose of this project was to examine the initial stages of the species' life history: seed germination and youngling survivorship. Initial tests determined that seeds are dormant at maturity. This study attempted to discover the necessary seed dormancy-breaking conditions and to determine the necessary growth medium for maximum youngling establishment. Mature seeds were placed in a 5° C incubator for varying time periods (0-12 weeks), simulating the cold stratification that seeds would receive in the field during winter, following autumn dispersal. Each treatment was moved to 30, 25, 20, and 15°C incubators, respectively, and germination was monitored. To determine ideal growth medium conditions, G. flavida younglings were placed in four different soil treatments (mychorrizal inoculated, non-mychorrizal, field site, sterilized field site) and then monitored for survivorship over a 30 day period. Results indicated that the 12 week cold stratification treatment produced a significantly higher percent germination (78%) than stratification at 10 (68%), 8 (61%), 4 (8%), or 0 (0%) weeks at 25°C. Germination did occur at the lower temperatures (20°C and 15°C), but to significantly lower percentages. At the lower temperatures, only cold stratification of 12 and 10 weeks produced significant germination; however, no treatment produced better than 44% germination. These results differ greatly from the known requirements for the only other native Kentucky species (G. quinquefolia) for which germination requirements have been formally reported; seeds of this species germinate only at lower temperatures. Among the growth medium treatments, soil collected from the field site contained younglings with the highest youngling survivorship (67%), significantly higher than the other three treatments. Potting media that contained mychorrhizal inoculants showed higher survivorship (38%) than media that was not inoculated (2%) and sterilized field site soil (0%).

1528 - The natural history and conservation of *Boechera serotina* (Brassicaceae) in Pendleton County, West Virginia

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Shale barren rock cress (*Boechera serotina*) is a federally endangered member of Brassicaceae restricted to Devonian shale barrens and adjacent shale slope woodlands in West Virginia and Virginia. It is thought to be endangered due to its limited natural habitat, as well as loss of habitat from road development, grazing by livestock, and canopy closure through succession. The site of this study, the Little Fork Shale Barren in Pendleton County, West Virginia, is on property owned by the U. S. Navy. Studies by the authors are documenting the development stages of this species via a combination of time-lapse photography and direct observations. Pollination studies, flower visitor observations, and nectar sampling are other components of the research being conducted. The potential effect of herbivory on this species is also being considered. Results suggest that the shale barren rock cress is a facultative biennial, perhaps better described as a short-lived, monocarpic perennial. Results also indicate that the shale barren rock cress is self-compatible. Vectors, such as insects are no doubt involved, but they are not necessary as this species is capable of autonomous autogamy. Flower visitor observations have resulted in two primary candidates for reliable pollinators, both of which appear to be halictid or sweat bees. Although a small quantity of nectar was visible at the base of each flower, production was not sufficient for collection using micropipets. Several young inflorescences appeared to have had their tips removed by a browsing animal, possibly a white-tailed deer. Additionally, several showed signs of damage by caterpillars. This is the first documentation of insect larvae using the shale barren rock cress as a food source, and as such is undergoing further investigation. Presently, the greatest threat to *Boechera serotina* at this site appears to be competition from crown vetch and Japanese stilt grass.

1531 - Niche Separation of Virginia Populations of the *Viola Subsinuata* Complext Supports Recognition of Four Morphospecies.

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The acaulescent blue violets in *Viola* subsect. *Boreali-Americanae* are a taxonomically complex group in North America. One polymorphic species in this group, *Viola subsinuata* (Greene) Greene, encompasses morphological and ecological diversity and represents a complex of potentially distinct evolutionary species. A newer taxonomic approach, integrative taxonomy, often uses the Unified Species Concept to evaluate many different lines of evidence in species delineation, including morphological differences, genetic marker differentiation or environmental niche (microhabitat) separation. Niche separation is a well-known and accepted concept in plant ecology. We have documented macromorphological distinctions for four recognizable phenotypes, "*tenuisecta*", "deeply lobed", "Blue Ridge" and *V. subsinuata* sensu stricto. Sites (total n = 28) in the Virginian Appalachian Mountains. This phase of the investigation tested for niche separation among the four morphologically based phenotypes. A variety of environmental traits were collected, and soil samples were taken for analysis. Initial data screening implied a difference in certain environmental characters, including elevation, slope grade, herbaceous cover, pH, and soil texture for each phenotype. Results were visualized using a canonical variates analysis. A one-way PERMANOVA found significant differences among the following phenotype pairs, "blue ridge" vs. "deeply lobed" ($F = 7.20$, $p < 0.001$), "Blue Ridge vs. "*tenuisecta*" ($F = 9.40$, $p < 0.001$), "Blue Ridge" vs. *subsinuata* sensu stricto ($F = 4.21$, $p < 0.01$) and *subsinuata* sensu stricto vs. "*tenuisecta*" ($F = 4.86$, $p < 0.001$). Results supporting niche separation suggested that the *V. subsinuata* complex consists of at least three distinct evolutionary species in Virginia. Final conclusions await completion of genetic marker analyses using microsatellites, and examinations of seed micromorphology, now in progress. Research funding was provided by the Virginia Native Plant Society and the Southern Appalachian Botanical Society.

1533 - Novel morphologies in the *Allium tricoccum* (Wild Ramps) Complex and their systematic impact

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Allium tricoccum is a native species in eastern North America with broad morphological variation. Previous studies have led to contrary classifications to account for the diversity of morphologies in *Allium tricoccum.* Living plants of *Allium tricocum* or Ramps were collected from 28 natural populations (plants totaling 140) in seven states. Plants were cultivated in the Ohio University common garden for biweekly observation of morphological traits, growth patterns and phenology of leaves, flowers and fruits; and weekly photography of plant structures. Digital morphological measurements were conducted with the ImageJ program. Nonmetric Multidimensional Scaling and UPGMA clustering were applied to the morphological traits to examine variation within and distinctions among four recognizable phenotypes. Two new characteristics of the species were described for first time, scape growth direction and depth of bulb in the ground. Two major groups of *Allium tricoccum,* Red Ramps and White Ramps, were broadly distinguished based on many differences in leaf shape and size; pigmentation of leaf, scape and bulb; number of buds, flowers and fruits; scape growth direction, bulb size and depth in the ground. Additional phenotypes of White Ramps were readily separated, one from the Great Lakes (*A. burdickii*), perhaps a second from the Interior Highlands of Kentucky and Tennessee, and a third from the central and southern Appalachian highlands. The third phenotype had leaf blade shape similar to Red Ramps, pigmentation pattern like the Great Lakes or Interior Highland White Ramps, but sizes and numbers of flowers and fruits intermediate between White and Red Ramps. This third taxon in particular has likely served as the source of problems in assigning plants confidently in a two-taxon classification. Microsatellite markers are currently being applied to determine the degree of genetic differentiation in the three to four phenotypes.

1536 - *Lys-3* and *lys-8* gene expression in *E. aerogenes* and *B. thuringiensis* infected *C. elegans*

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C. elegans, lacking an adaptive immunity, must employ internal, innate mechanisms in order to defend themselves against established infections. Previous studies have observed the use of toxins, antimicrobial proteins and, the focal point of this study, lysozymes as defense mechanisms. C. elegans' 15 lysozyme genes (lys genes) have been found to be up- and down-regulated to varying degrees, depending on the pathogen, in response to infection. The focus of this study is to observe how the lys-3 and lys-8 genes are regulated against E. aerogenes and B. thuringiensis-kurstaki (Btk) infections. It was hypothesized that both lys genes would be upregulated in response to either infection, but more so against Btk – a nematode specific pathogen – due to a potential evolutionary relationship that may exist between C. elegans and Bt. It was found that both infections lead to an increase in lys-3 and lys-8 gene expression, but higher levels of expression were observed in the E. aerogenes infection group. Further insight into how C. elegans employ lysozymes to fight pathogens could lead to new avenues of treatment for humans, particularly against gram-negative bacteria such as E. aerogenes.

1550 - Community-Associated Antibiotic Resistance on a College Campus

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Antibiotic resistance poses a formidable threat to the treatment of everyday infections, but a greater understanding of resistance and how it develops will provide opportunities for prevention. Although hospital-acquired resistance is a main propagator of the resistance epidemic, it is widely accepted that community-acquired antimicrobial resistance is growing; however, there is a gap in the research when it comes to college campuses as communities of resistance. This study assesses the prevalence of carriage of *Escherichia coli* and *Staphylococcus aureus* and, within positive isolates, the prevalence of antibiotic resistance. To assess levels of carriage of antibiotic resistant bacteria in college students, two bacterial species, *E. coli* and *S. aureus*, were isolated from college students using selective media and tested for phenotypic resistance to antibiotics using the Kirby-Bauer disk diffusion method. At the time of sampling, students also completed a demographic and lifestyle survey based on previous research that found relationships between certain demographic factors and lifestyle habits and prevalence of antibiotic resistance. Sequencing was performed on a portion of the samples to confirm the results of the selective medium cultures. Patterns of resistance were identified both among different antibiotics and in relation to demographic factors and lifestyle habits. This study explicates the role of antibiotic resistance in a college setting as well as what demographic factors and lifestyle choices affect development of resistance in college students.

1563 - Can we find our way home? *Gopherus polyphemus* response to relocation.

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In 2015-2016, a population survey of gopher tortoises (*Gopherus polyphemus*) was conducted to determine the overall population and locations of gopher tortoises in the original tract of San Felasco Hammock Preserve State Park; as part of the monitoring of “species of interest” management plan for the park. It was ascertained that 42% of gopher tortoises were located along the powerline right-of-way (ruderal habitat). In 2016, the 45 adult gopher tortoises and 19 juveniles were removed from the power line right-of-way and relocated throughout the park. The power company was replacing all of the power poles and need to remove the gopher tortoises to prevent them from being injured by equipment. Relocation involved the burrows being dug out until the end of the burrow was reached. If a gopher tortoise was within the burrow it would be placed in a container and relocated that same day. Once the work was completed (early in 2017), the right-of-way was surveyed to see how many burrows remained. The right-of way has been repeatedly surveyed through December of 2017; in that time a number of gopher tortoises moved back into the power line but there were not near the number of burrows that there were before they were relocated. One item of particular interest was that of some of those gopher tortoises that returned to the easement, a number of them dug their burrows in the woods, 3 to 8 meters off the right-of-way. This location will allow them access for foraging (their trails to the right-of-way are readily visible) and prevent their burrows from being disturbed by heavy equipment moving through the power line easement.

1583 - Investigation of the reproductive traits in the spiny dogfish (*Squalus acanthias*) off the GA/SC coast using microsatellite analysis.

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The spiny dogfish (*Squalus acanthias*) is the target of the largest US shark fishery and has a global distribution with distinct identifiable populations throughout their range. Large females are the most desirable catch and they are essential to maintaining a healthy population size. Understanding distinct populations is essential in conservation efforts for the spiny dogfish. Previous work on spiny dogfish in US waters have concentrated on sampling from New England or the North Carolina/Virginia coast. The reproductive traits of these sharks have

been described, but little can be found about the southernmost part of the population, including those occupying the coast of South Carolina and Georgia. This study investigated the reproductive biology of the spiny dogfish in the southernmost region. Female spiny dogfish and their pups (n = 20) were sampled and five microsatellite loci were used to determine overall heterogeneity and paternity. Both litter size and genetic diversity were consistent with values reported in other parts of the range. In addition, no evidence of multiple paternity or parthenogenesis was found in the three family groups. Despite the small sample size, these data suggest the spiny dogfish along the coast of South Carolina and Georgia are similar in overall genetic diversity to others in the Western North Atlantic population; therefore, for conservation purposes it may be a single management unit. The reproductive habits, genetic composition and population structure of the southern stock of spiny dogfish should be assessed more completely. As recently as 2005, spawning stock biomass was below the acceptable threshold for the Western Atlantic population. Any clarity this study can provide to the management and sustainability of the spiny dogfish would be a positive step for shark conservation.

1588 - Sedges of the Carolinas-A Conspectus

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Radford, Ahles, and Bell (1968) include 291 sedge taxa for North and South Carolina; Weakley (2015) includes 410. Twenty five taxa are newly described. Thirty five are new discoveries in one or the other state. Thirteen were formerly misidentified as other taxa. Thirty eight were formerly synonymized or overlooked but are now elevated to species or varietal status. Eleven species have been deleted from the flora of the Carolinas due to misidentification, misattribution, or lack of documentation. The Carolinas include species which are endemic to as few as two counties and others which are pan-tropical. Sedges occur in nearly every recognized habitat in the two-state region and represent phytogeographic regions as disparate as the tropics and the subarctic. Even now, after 300 years of botanical investigation, taxa new to the Carolinas are being detected, including undescribed species.

1596 - Indirect effects of a competitor on life history and reproductive traits in a cavity nesting bird

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Research on life history evolution in birds has revealed both direct and indirect effects of predation. Increased levels of nest predation favor reproductive behaviors that reduce the threat of predators on offspring or allow parents to bet hedge for future reproductive attempts. In this study, we investigate whether the presence of a competitor, the house wren (Troglodytes aedon), results in similar indirect effects on life history and reproductive behaviors of Carolina chickadees (Poecile carolinensis). House wrens compete for nesting cavities and will kill Carolina chickadee eggs and nestlings. We monitored nest boxes in Western North Carolina where exposure to house wrens varies. We surveyed house wren presence at active Carolina chickadee nests and measured clutch size and mass, incubation, provisioning rates, nestling growth rates, development, and fledging success of chickadees. House wren takeover accounted for 38.77% of nesting failures, more than any other cause of failure in our study. We found that the presence of house wrens resulted in smaller Carolina chickadee clutch sizes. However, we did not detect any effects of house wren presence on chickadee egg size, incubation, provisioning, growth, or development. These results suggest that house wren presence affects a narrow range of life history traits early in the nesting period, possibly because this is when house wrens are the biggest threat. Reducing clutch size may be a

strategy used by Carolina chickadees to decrease reproductive investment in an environment where early nest failure is probable, allowing adults to reserve energy for future reproduction.

1597 - Investigating the Potential Role of *nsy-1* in Response to an Oxidative Stressor

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Caenorhabditis elegans (C. elegans) serve as a model organism used to study the process of the loss of dopaminergic neurons due to the effects of treatment with 6-hydroxydopamine (6-OHDA). Research has shown that a mutation in the *nsy-1* gene, orthologous to the mammalian *ask-1* MAPKKK and part of the highly conserved p38 MAP kinase pathway, plays a role in the innate immune response activated during oxidative stress. In this study, *C. elegans* were treated with 6-OHDA in order to determine whether or not there was a mobility shift in treated nematodes versus untreated nematodes in two strains, AU3 *nsy-1* knockout and wildtype N2 nematodes. It was hypothesized that the *nsy-1* gene knockout nematodes would exhibit a normal mobility shift assay after treatment with 6-OHDA

1599 - High soil salinity reduces maritime forest regeneration

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Increased storm frequency on barrier islands exposes vegetation to increased salt spray. This change in climate regime may be partially responsible for the decrease in maritime forest regeneration that has been observed on the Virginia barrier islands. While mature trees may experience reduced growth due to higher salinities, earlier life stages may be more susceptible. Environmental stress may impact seed germination, posing challenges for susceptible species and future regeneration of these forests. The goal of this experiment was to experimentally investigate the effects of salinity on seed germination of common maritime forest species: *Pinus taeda*, *Liquidambar styracifula, Quercus rubra*, *Juniperus virginiana* and *Celtis occidentalis*. We tested the hypothesis that an increase in soil salinity will decrease germination in all species. In a growth chamber experiment we exposed tree species to 5 different soil salinities (0, 2, 5, 10, and 20 g L^{-1}). Results show that germination was greater at lower salinities (0, 2, 5 g L^{-1}). Some species responded with a delay in germination at higher salinity levels. *Quercus rubra* had low germination rates at all salinities. Further analysis revealed that <10% of seeds were viable, suggesting that factors other than salinity may be important for its regeneration. These results show that increased salinity from salt spray and storm overwash will change the future community composition in coastal forests. Many species are intolerant of high salinity levels with delays in the timing of germination. Loss of maritime forests could alter barrier island structure (e.g. elevation gradients, soil erosion) and function (e.g. maintenance of freshwater aquifers, buffer for the mainland during hurricanes).

1603 - Preliminary Assessment of Movement Ecology in a West Tennessee Population of Alligator Snapping Turtles (*Macrochelys temminckii)*

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Alligator snapping turtles (*Macrochelys temminckii*) are experiencing population declines throughout their range; this decline is primarily due to habitat fragmentation and overexploitation. Currently, one of the only known populations in West Tennessee is being monitored in order to understand the habitat preferences and spatial use of *Macrochelys temminckii*. This population is composed of subadult turtles that were previously released and

monitored as hatchlings. Currently, little data is available for the subadult life stage of *Macrochelys temminckii* in comparison to hatchling and adult life stages. We hypothesized that the home range size will have increased since estimates taken from hatchlings and that turtles will select warmer microhabitats with a high percentage of tree cover. Preliminary data shows that the mean home range size for this first field season is 0.38 +/- 0.16 hectares. The mean distance moved per day by a turtle is 2.37 +/- 0.85 meters with trends showing differences in microhabitat. There also appears to be a correlation between the distance moved and water temperatures, with longer distances and more movements associated with warmer water temperatures. Continued monitoring of the habitat preferences and spatial use of this population will aid in future reintroductions and management protocols within West Tennessee. This study will also provide updated data for the IUCN in a state with currently little information available on *Macrochelys temminckii*.

1604 - Trade-offs between social dominance and running economy in male house mice

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Economical locomotion and maintaining social dominance are vital to many species because of their direct impact on components of fitness. Locomotor economy is thought to be an important performance trait because it directly influences total daily energetic expenditure. For example, reduced locomotor economy and the subsequent higher energetic demand may increase viability costs, such as increased foraging time and exposure to predation, as well as decreased free energy for growth, maintenance, and reproduction. Social dominance is important because it often directly determines reproductive success. In species that fight to determine social dominance, fighting performance may be under strong selection. However, traits that improve either fighting ability or locomotor economy may decrease performance in the other, resulting in a trade-off. We used populations of wild-derived house mice (*Mus musculus*) in 8-week social competition trials in semi-natural enclosures to directly measure several aspects of male reproductive fitness including social dominance through control of female-occupied territories. In addition, we measured locomotor economy for each male across a range of intermediate speeds using running trials in an enclosed treadmill and open-flow respirometry. Our results indicate that socially dominant male mice have a higher cost of transport (i.e., reduced locomotor economy) than non-dominant males. This relationship was significant for measurements taken both before and after social competition trials. In contrast to the positive correlation between body mass and social dominance in other species, body mass was not predictive of social dominance in our populations of mice, indicating that other physiological, musculoskeletal, or behavioral traits underlie these performance differences. These results represent the first empirical evidence of a trade-off between economical locomotion and social dominance capacity in a mammalian species.

1609 - Habitat preference and herbivory effects in a rare plant preserve with reduced human interaction

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White-tailed deer (*Odocoileus virginianus*) populations has been increasing across the country in light of their near-extirpation at the beginning of the 20th century. Due to this recovery, there have been serious concerns as to what ecological, economic, and social impacts may occur. This study utilizes trail camera technology to determine species richness, habitat selection, to what degree habitat is exploited by wildlife, and describes potential herbivory of rare plant communities. The study focuses on a natural habitat where limited amounts of human interaction have occurred for nearly 40 years. The 486-hectare Tater Hill Plant Preserve of Watauga County, NC, currently protects more than 20 rare and state listed species of plants

from development and human encroachment. The Tater Hill Plant Preserve habitats range from high elevation rock outcrops, rich cove forest, northern hardwood forest, to mountain bog ecosystems. Trail camera technology was paired with ArcGIS software to understand patterns of activity and interpolation of potential herbivory effects. White-tailed deer occupancy of area was calculated along with interpretation of animal's actions while within selected habitat. This information can assist conservation in determining areas to focus resources and provides a better understanding of potential ecological barriers to recovery.

1626 - Structure, resilience, and fate of large river bacterial communities

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The community structure formation, persistence, and resilience of lotic bacteria in large river settings were investigated using next-generation pyrosequencing. The bacterial communities from samples collected from six sites within the Greenup Pool of the Ohio River were >85% similar on a sequence basis, indicating the bacterial community of the Ohio River within a pool is well mixed. Another set of 10 samples was collected along the length of the Ohio River approximately every 100 river miles. These sequence data indicate the Ohio River has a core bacterial community that makes up > 90% of the total bacterial population along the entire length of the Ohio River and that this community is relatively stable to perturbation. Further exploration revealed that a core community was present from the source to the mouth of the Kanawha River, but not in a smaller tributary of the Ohio that had changing flow regimes. Samples from large rivers (James River, Roanoke River) draining a different watershed were pyrosequenced to determine whether they also had a core community and whether that core community was similar to that found in the Ohio River. Finally, the fate of lotic bacterioplankton was determined by pyrosequencing of samples collected along the transition from freshwater to seawater in the Mattaponi River.

1635 - Intruder Alert! Fiddler Crab Response to a Same Species Invader

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Fiddler crabs are known to be territorial of their burrows and tend to have well-maintained dominance hierarchies in their social system. These crabs are sexually dimorphic; males have an enlarged claw known to be used for courtship and territorial displays. However, few studies have investigated the nature of territoriality in fiddler crabs in a controlled setting. The current study examined behavior of Uca pugilator, the sand fiddler crab, which is native to estuarine mud flats on the eastern coast of the United States. The purpose of this study was to better understand how fiddler crabs respond to intruders on their territory given a specific social dynamic. All crabs were acquired from the field and brought into the laboratory where they were placed in simulated natural environments. Four individuals, three females and one male, were put into the observational tank and left to acclimate and establish their personal space for roughly twenty-four hours. Then an intruder male was placed into the community and the reactions of each individual was observed and recorded for a maximum of fifteen minutes. Observations suggest that males tend to display possessive behaviors over the resident females when threatened by another male. Females tended to show a team effort response when the resident male failed to display dominant behaviors against the intruder. These results have implications for the complexity of the social structure and dynamics within fiddler crab communities that seem to be dependent upon neighbor familiarity. Keywords: aggression, community

1638 - Assessing potential scavengers in a fragmented forest in Panama using baited cameras

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Very little is known regarding the extent of scavenging by mammals in Neotropical regions, particularly in fragmented forests experiencing increasing anthropogenic effects and changes in land use. One of the main methods to assess scavenging behavior and ecology requires dangerous chemicals to immobilize animals so that expensive tracking devices can be attached. However, camera trapping provides a non-invasive methodology for assessing mammal communities and potentially identifying scavengers in tropical ecosystems. We deployed camera traps in two fragmented forests of the Chiriqui province, country of Panama. We detected a total of ten species actively scavenging with the most abundant Neotropical scavenging mammal being the common opossum (*Didelphis marsupialis*), with the cacomistle (*Bassariscus sumichrasti*) actively scavenging in mountainous regions. This research documents the potential for short term effective use of camera trapping to assess mammal relative abundance and study scavenging in Neotropical ecosystems.

1645 - Relationships between tree density and the growth and survival of longleaf pine (Pinus palustris) at Blackwater Ecological Preserve in Isle of Wight County, Virginia

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The Blackwater Ecological Preserve (BEP) in Isle of Wight County, Virginia contains the northernmost extant reaches of the Pinus palustris (longleaf pine) ecosystem. Longleaf pine savanna and longleaf pine-turkey oak are two state-rare, pyrophytic plant communities present at BEP that are managed with prescribed burning. In summer 2016 we geo-located and measured diameter at breast height (DBH) and height of all P. palustris older than grass stage at BEP, finding a total of 1960 sapling and mature trees. Heat map analysis in ArcGIS showed several centers of high density of P. palustris that we recognized as stands in subsequent analyses. The relationship between DBH and height was found to be best modeled as variable across these stands. We hypothesized that variation in resource competition drives variation in the DBH-height relationship among stands of P. palustris at BEP. We treated total tree density as a surrogate for competition and tested for significant variation among stands in this metric using data from randomly selected 10 m x 10 m survey plots. Stand-specific estimates of tree density were compared to stand-specific DBH-height relationships. Under our hypothesis we expected more growth in height than diameter in stands with high overall tree density and a curvilinear relationship between DBH and height in such stands. Seedlings of P. palustris present in randomly selected 5 m x 5 m plots at BEP were given unique tags in summer 2016 and spring 2017. Generalized linear models were used in an information-theoretic framework to investigate the importance of canopy openness and root collar diameter on survivorship of P. palustris seedlings at BEP.

1646 - Extended flowering phenology as a shared trait among hubs in a plant-pollinator network

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Plant-animal networks are structurally heterogenous, meaning they consist of highly connected species in each involved community, often referred to as hubs. Hubs are crucial for maintaining the structural integrity of these ecological networks, in the sense that should one be removed, the network faces probable collapse. Our study aims to understand if hub species

can be identified by shared traits. Specifically, we focus on plants with an extended reproductive phenology, as this trait has been hypothesized to be associated with hub species. Neotropical regions offer an ideal system for this investigation, owing to the higher number of plant species with an extended reproductive phenology, including that certain plants flower or fruit throughout the entire year. We focused on plant-pollinator networks and therefore species that flowered all year. We sampled various planted and naturally occurring shrubs, collecting every flower visitor for 30-minute observation periods. Functional group richness and species richness were compared across different plant species to see whether the various shrub species supported similar proportions of the pollinator community. Preliminary results indicate that plant species supports its unique pollinator community and that conservation efforts in the Neotropics will require planting a diversity of plant species rather than just a few species with extended flowering seasons.

1651 - Building more resilient ecological and human communities: A project to quantify coastal threats to key fish and wildlife habitat and human community assets and identify opportunities to support high impact "coastal resilience" projects.

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In the face of increased coastal threats such as Hurricane Irma and Superstorm Sandy, it is important that we look for efficient ways to build more resilient human and ecological communities. To begin to address this need, NFWF is working with NatureServe and UNC-Asheville's NEMAC in seven watersheds throughout the country to identify important human assets, important fish and wildlife habitat, and the level of current and potential future threat to those assets. Based on that analysis, our team can then identify key "resilience hubs" and potential "resilience projects" that serve as opportunities for building community and habitat resilience before storms and flooding intensify. In our talk today, we will present draft results of our Charleston Harbor watershed resilience study and explain next steps in our work, including data layers and conservation planning tools that will become available to everyone once the analysis is finalized.

1652 - Expanding the roles of exogenous fatty acids in Gram-negative bacteria

Joshua Herndon, Chelsea Hobby, Lyssa Baker, Colton Morrow, Steven Symes, David Giles

University of Tennessee at Chattanooga, Chattanooga, TN

Bacteria must capitalize on environmental components and cues for survival. An emerging theme in microbiology is the ability of some bacteria not only to assimilate exogenous fatty acids into their membrane phospholipids, but also to alter their behavior in ways that may impact virulence. Previous studies from our laboratory have investigated the fatty acid responses of *Vibrio* species and *Acinetobacter baumannii*. Recently, our laboratory has expanded the list of Gram-negative bacteria possessing exogenous fatty acid handling capabilities to include *Pseudomonas aeruginosa*, *Klebsiella pneumoniae* and *Escherichia coli*. Ultra performance liquid chromatography/ESI mass spectrometry indicated incorporation of all 7 polyunsaturated fatty acids (PUFAs) tested into the phospholipids of *P. aeruginosa*, *K. pneumoniae* and *E. coli*. Membrane permeability assays using crystal violet and ethidium bromide revealed varied effects depending upon genus. PUFAs also affect other bacterial behaviors, including biofilm formation and motility. Interestingly, arachidonic acid significantly increased biofilm production in all three bacteria, while most PUFAs significantly decreased swimming motility in *P. aeruginosa* and *E. coli*. Notably, the availability of certain PUFAs alters the minimum inhibitory concentration (MIC) of the cyclic peptide antibiotics polymyxin B and colistin, leading to susceptibility in *K. pneumoniae* and resistance in *P. aeruginosa*. Specifically, alpha- and gamma-linolenic acids lowered the MICs by 4-fold in *K. pneumoniae*,

while arachidonic acid induced an 8-fold increase in resistance to polymyxin B in *P. aeruginosa*. Together, our results highlight the importance of exogenous fatty acids in the lifestyles of Gram-negative bacteria. Many veins of research have been opened for mechanistic studies to further elucidate the role(s) of PUFAs in bacteria of medical importance.

1657 - An *in vitro* Analysis of the Relative Efficacies of Antibiotic Solutions vs. Antiseptics Used for Irrigation in Breast Augmentation Surgery

Victoria Noyes[1], Henry Spratt[1], David Levine[1], Mark Brzezienski[2], Mathew Epps[2]

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Breast augmentation and reconstruction procedures are among the most popular plastic surgeries in the U.S. Opportunistic bacterial pathogens introduced during surgery can lead to surgical site infections, capsular contractions, biofilm formation; and, rarely, lymphoma. To limit the incidence of these infections, an antibiotic solution containing Cefazolin, Gentamicin, and Bacitracin (Adams Solution - AS) has traditionally been used for surgical site irrigation. Due to antibiotic resistant pathogens, and a debate over the efficacy of irrigation with AS to reduce infections, alternatives must be investigated. This study considers the use of a detergent form of the antiseptic chlorhexidine gluconate (CHG) as an alternative surgical irrigation solution. *In vitro*, we exposed pure cultures of six bacterial species (*Acinetobacter baumannii, Enterococcus faecalis, Escherichia coli*, methicillin resistant *Staphylococcus aureus, Pseudomonas aeruginosa, Staphylococcus epidermidis*) known to cause infections during this surgery to: AS, CHG (0.05% dilute Hibiclens), or a saline control (SAL) for one, two, or five minutes. Viable plate counts before and after exposure allowed calculation of the percent survival for each bacterial species. Across all time intervals for exposure to the irrigation solutions, the average survival of CHG irrigated cultures was zero percent. Survival rates following SAL irrigation were between 63.1-104%, and those following AS exposure were between 62.5-100%. Student's t-tests suggest that differential bacterial survival for CHD and SAL treatments were significant ($p < 0.05$). However, comparison of bacterial survival in AS and SAL treatments were not significant (Student's t-test, $p > 0.05$). These results suggest that use of CHG for irrigation is more effective at killing potential pathogens than AS, and that AS is no more effective than using SAL. This finding has the potential to change the standard of care in breast augmentation surgical procedures.

1663 - Exogenous fatty acids alter phospholipid composition and influence virulence-associated phenotypes in *Klebsiella pneumoniae*

Rachel Peters, Chelsea Hobby, Joshua Herndon, Colton Morrow, Steven Symes, David Giles

University of Tennessee at Chattanooga, Chattanooga, TN

Klebsiella pneumoniae represents a major threat to human health due to a combination of its nosocomial emergence and a propensity for acquiring antibiotic resistance. Dissemination of the bacteria from its native intestinal location creates severe, complicated infections that are particularly problematic in healthcare settings. Thus, there is an urgency for identifying novel treatment regimens as the incidence of highly antibiotic resistant bacteria rises. Recent findings have highlighted the ability of some Gram-negative bacteria to utilize exogenous fatty acids in ways that modify membrane phospholipids and influence virulence phenotypes, such as biofilm formation and antibiotic resistance. The current study explores the ability of *K. pneumoniae* to assimilate and respond to exogenous fatty acids. All 7 fatty acids improved the growth of *K. pneumoniae* when supplemented individually in minimal media. Additionally, each fatty acid supported growth when supplied as the sole carbon source. The combination of thin-layer chromatography liquid chromatography-mass spectrometry confirmed adoption of numerous exogenous polyunsaturated fatty acids (PUFAs) into the phospholipid species of *K. pneumoniae*. Membrane permeability was variably affected as determined by two dye uptake

assays. Furthermore, the availability of many PUFAs lowered the MICs to the cyclic peptide antibiotics polymyxin B and colistin. Biofilm formation was significantly affected depending upon the supplemented fatty acid. Taken together, the results recognize *K. pneumoniae* as capable of assimilating exogenous fatty acids into its membrane phospholipids, as well as fatty acid effects on several phenotypes important for survival and virulence.

1667 - Range-wide *ex situ* seed conservation and population genetic architecture analysis in Venus flytrap (*Dionaea muscipula*)

John L. Randall, Jamie Winshell, Corbin D. Jones, Gregory P. Copenhaver

University of North Carolina at Chapel Hill, Chapel Hill, NC

Venus' flytrap (*Dionaea muscipula*) is the most widely recognized carnivorous plant, and endemic to only 100 km landward radius around Wilmington, North Carolina, USA. Although a few large populations occur on protected lands, the number of individuals is declining, entire populations are being extirpated, and a seemingly secure species is now vulnerable to local extinction and loss of wild genetic variation. We used Restriction site-Associated DNA sequencing (RAD-seq) to evaluate the genetic architecture of Venus' fly trap populations across its entire range. In addition, we collected and banked over 25,000 seeds from 30 populations as a long-term conservation resource. Initial analysis of 160 RAD-seq derived markers indicate limited genetic variation within the first population sampled. Genetic variation was surprisingly heterogeneous across loci with some populations harboring appreciable variation and others harboring next to none. This initial analysis is ongoing for approximately 150 populations to provide a high-resolution assessment of the existing genetic variation which will help guide future conservation efforts and to access species phylogeography.

1669 - The vascular flora of the Red River Gorge in Menifee, Powell, and Wolfe Counties, Kentucky

Thomas McFadden, Brad Ruhfel

Eastern Kentucky University, Richmond, KY

The Red River Gorge (RRG) is a 26,283 ha. expanse of public United States Forest Service (USFS) land that is located along the western edge of the Cumberland Plateau physiographic region of KY within Menifee, Powell, and Wolfe Counties. The RRG is floristically distinctive because it is geologically diverse. Vast sandstone cliff faces and a multitude of rock houses and rock arches have allowed a unique floristic community to develop. In fact, the RRG is home to white-haired goldenrod (*Solidago albopilosa* E.L. Braun); a species that is entirely endemic to the driplines of rock-houses in the RRG (White and Drozda, 2006). The ongoing flora of the RRG began in fall 2016. A species area curve estimates that ca. 975 species should occur at the RRG. Currently there are 930 species that we have vouchers for. The Kentucky State Nature Preserves Commission reports that 19 species of conservation concern are within the RRG; however, 16 of the reports are over 20 years old, with poor locality descriptions, and no vouchers to confirm the record. Through this project, ten of the 19 species of conservation concern have been newly vouchered or located in herbaria. Additionally, one new species of conservation concern *Scutellaria saxitalis* Riddell was discovered. The species list for this flora is publically available through the SERNEC Symbiota Portal (http://www.sernectportal.org), with all vouchers digitally linked to each species.

1670 - Environmental niche divergence in Southeastern *Kalmia* species; integrating phylogeny, community composition and ecology

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Elucidating the processes that contribute to patterns of biodiversity is a longstanding goal of ecological research, and one that intensifies as patterns of global climate change accelerate. Recent research is highlighting the influence community context exerts on focal species' range dynamics and niche evolution, yet most research on range dynamics fail to incorporate biotic interactions. Synthesizing evolutionary perspectives with ecology to better disentangle these factors has resulted in a recent emergence of strategies to incorporate phylogenetics into community ecology. Integrating novel methods in the emerging field of community phylogenetics along with ecological data, we investigated phylogenetic and community assembly patterns in *Kalmia* occurring in the southeast USA to better disentangle biotic and abiotic factors that govern species overlapping ranges. By integrating current abiotic and biotic habitat composition with evolutionary relationships, utilizing a current time-calibrated species-level phylogeny of seed plants and examining 60 vegetation plots across the range of three overlapping *Kalmia* species, we attempt to understand the processes that structure the distributions of these closely related Ericaceous shrub species. Using this compiled dataset, we were able to ask if the geographic distribution of these focal species is related to local-scale community factors, or broad-scale climatic factors. The results of this analysis can then be applied to ongoing and future management and conservation decision-making.

1673 - The Effects of Antimicrobial Peptides WAM-1 and LL-37 on Multidrug Resistant *Acinetobacter baumannii*

John Spencer, Rowan Pitts, Rachel Pearson, Lauren King

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Increasing multi-drug resistance (MDR) in *Acinetobacter baumannii* warrants therapeutic alternatives, and the bactericidal nature of antimicrobial peptides offers a possible approach. In this study, we examined the interaction of cathelicidin antimicrobial peptides (AMPs) WAM-1, a marsupial AMP, and LL-37, a human AMP, with *A. baumannii* clinical isolates. We characterized the antibiotic resistance of the isolates, the bacteriostatic and bactericidal effects of these AMPs, synergistic activity with antibiotics, and their effects on biofilm formation and dispersal. All clinical isolates were resistant to commonly prescribed antibiotics, with four of seven isolates showing multidrug resistance. WAM-1 and LL-37 showed variable activity in clinical isolates, with WAM-1 having a stronger bacteriostatic effect than LL-37 and showing rapid bactericidal activity against clinical isolates. Furthermore, synergistic bactericidal activity was observed with WAM-1 and commonly prescribed antibiotics. Both peptides were able to inhibit biofilm formation in all clinical isolates at some concentrations, and WAM-1 dispersed mature biofilm in most isolates. LL-37 was unable to disperse mature biofilms in any strains. Further studies must be done to elucidate the true value of these alternative treatments, but these results suggest that multidrug resistant *A. baumannii's* susceptibility to AMPs may result in innovative therapeutics to prevent or treat these infections.

1682 - Sands of time: a 32-year analysis of the Virginia barrier islands

Ben Nettleton, Julie Zinnert

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The barrier islands of the Virginia Coast Reserve LTER site (VCR) are in a "hotspot" of sea level rise, with an average rate of 5.38mm yr-1 from 1978-2016. Barrier islands can maintain elevation above rising sea level with their ability to "rollover" (i.e. migrate landward), via overwash of sediments from the island onto the back-barrier marsh. Previous literature has focused on responses of change at the island scale. Species composition and vegetation cover can influence susceptibility to overwash disturbance, creating feedbacks with elevation and rates of island migration at the sub-island scale. Our objective was to assess broad scale ecosystem state change and quantify barrier island upland migration at the VCR over 32 years (1984-2016). Using ten islands, we classified vegetation cover of Landsat imagery in 1984,

1998, 2011 and 2016 and quantified transitions between classes (bare, grassland, woody, marsh and ocean) at both the island scale and at 1 km island subsections. We also calculated rates of upland migration onto the back-barrier marsh between each timeframe. System-wide, we found net losses of 50 hectares of upland, 1100 hectares of marsh, and 1300 hectares of marsh that converted to upland since 1984. Rates of barrier island migration have increased dramatically in the last few years. We found significant variation in upland migration rates both system wide and within individual islands that does not fit with previously defined classification schemes for the VCR islands. Presence of woody vegetation and increased elevation correlate with slower rates of upland migration. We show that overall landward island migration is a function of complex local scale movements and vegetation interactions within an island. These results highlight the complex ways barrier islands are responding to sea level rise and storm events, and stresses the need to quantify local scale processes for better coastal prediction.

1691 - The legacy effects of a transient apex predator in a freshwater food web

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While organisms are typically considered permanent residents of a community, there are many transient organisms who occupy a community for only brief periods. Despite the short duration, the effects of a transient predator may remain long after departure (e.g. legacy effects). To test hypotheses on transient apex predator effects on wetland communities, we used mesocosms and constructed food webs that varied in trophic levels. The food web used in this experiment contained two prey species (frog tadpoles), two intermediate predators (fish and crayfish), and one apex predator (freshwater turtle). To evaluate legacy effects on community dynamics, an apex predator visit was simulated for four days. Predation on Hyla chrysoscelis by Lepomis macrochirus lowered the mean survival of tadpoles in all treatments, including the treatment with Chelydra serpentina, compared to the control. Although C. serpentina had no effects on H. chrysoscelis tadpoles, the apex predator lowered mean survival and increased mean mass of Rana sphenocephala when compared to the fish only and intermediate predators and all treatments, respectively. Therefore, our results suggest that brief visits from transient organisms, especially apex predators, can alter community dynamics and initiate legacy effects.

1692 - Threatened and Endangered Species' Response to Raccoon Creek Stream Restoration

Alexandria Lamle[1], Bill Ensign[2], Katie Owens[1], Brett Albanese[3]

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Raccoon Creek is a tributary of the lower Etowah River and a stronghold for a number of species that are not found in the mainstem Etowah below the Allatoona hydro dam. Among these species are the federally endangered Etowah Darter (*Etheostoma etowahae*) and the federally threatened Cherokee Darter (*Ethesotoma scotti*). In 2012 restoration, enhancement, and biostabilization of ~ 6,441 feet of channel was completed to improve aquatic habitat for Etowah and Cherokee Darters. Since 2009 The Nature Conservancy, Georgia Department of Natural Resources, Kennesaw State University, and Paulding County Water System have collectively monitored this reach as well as an upstream and downstream control reach. These monitoring data show few trends and suggest that 5 years is not enough time to determine the success of this type of stream restoration project. While more monitoring will be required to determine the impacts of this restoration, this project does provide an excellent model for collaboration between local governments, state and federal agencies, mitigation groups, NGOs, and research institutions.

1694 - Systematics of *Achlya* spp (Oomycota) with emphasis on pathogenic isolates

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Watermolds are siphonous, multinucleate, heterotrophic stramenopiles that obtain their nutrition using a variety of different strategies. The genus *Achlya* includes over 50 species that have been described from freshwater, terrestrial, estuarine and marine habitats. Most *Achlya* spp are characterized as free-living osmotrophic saprobes but at least 12 species are facultative pathogens infecting an array of invertebrate, vertebrate, or plant hosts. Identifying *Achlya* isolates to the rank of species is notoriously difficult. This is because isolates often do not complete their life histories in culture and morphological concepts for *Achlya* spp mask a number of cryptic lineages. In this study ~50 novel isolates of *Achlya* were cultured and their morphologies were examined. DNA sequences were also determined for each isolate and combined and analyzed with previously published data. Maximum likelihood phylogenetic trees for *Achlya* spp were constructed using mitochondrial COII, nuclear ITS and 28S rRNA (LSU) DNA sequence data. Our phylogenetic framework was used to (1) reassess species concepts for *Achlya* and trace the evolution of different (2) nutritional strategies and (3) pathogenicity among *Achlya* isolates.

1704 - CRISPR in the Undergraduate Classroom

Heather Evans Anderson

Stetson University, Deland, FL

The CRISPR/Cas9 system has revolutionized modern science by simplifying access to targeted genetic editing. Use of this cutting-edge technology is possible in an undergraduate course and has the potential to be a powerful teaching tool to promote student engagement and encourage further participation in undergraduate research. A CRISPR-focused semester long project using mammalian cell culture was implemented in a standard 3hour per week lab across 15 weeks for a mid-level undergraduate Cell Biology course. At the end of the project, students wrote a lab report to summarize their work and present accumulated data. Remarkably, students were able to successfully edit their targeted gene; however, the ultimate goal of this implementation was to expose an entire class of 20 students to an exciting research project in order to promote engagement with undergraduate research. A classroom undergraduate research experience (CURE) post-course survey was administered to measure student experiences. The benefits of undergraduate research are widely cited but most undergraduate students do not get the opportunity to do independent research. This approach fulfills the 5 tenets that define a CURE (Auchincloss et al. CBE – Life Sciences Education, 2014), and expands the opportunity to engage a wider population of students in an undergraduate research experience than a traditional apprenticeship model. Furthermore, this approach also provides faculty a means for building independent undergraduate research programs. This project was supported within a typical lab course budget and can easily be modified to fit a wide variety of undergraduate students as well as easily be scaled up to large populations. Overall, the implementation of a semester long CRISPR project was an exciting way to engage an undergraduate class in a novel and relevant research project that was mutually beneficial to both students and the instructor.

1707 - Avoidance or Tolerance? Adaptations of the sand dune herb *Hydrocotyle bonariensis* in response to high light

Heather Joesting

Georgia Southern University Armstrong Campus, Savannah, GA

The sand dune environment can be a stressful place for plant growth and reproduction. In addition to the unique abiotic factors of the sand dune habitat, plants are exposed to high incident sunlight during the growing season, most pronounced at midday. Thus, native sand dune plants should have adaptations to prevent the negative impacts of excess light absorption, such as reduced photosynthesis (photoinhibition) and/or permanent leaf damage. *Hydrocotyle bonariensis* is a clonal herb commonly found in the sand dune habitat of barrier islands along the East Coast of the United States. This species produces a single broad-leaved ramet and has been observed in the field to possess a variety of leaf inclinations. The aim of this research was to investigate the strategies used by *H. bonariensis* to reduce the potential negative effects of high incident sunlight. Results suggest that leaf inclination from horizontal increases over the growing season and functions to reduce leaf sunlight incidence at midday while promoting sunlight absorbance in the morning and afternoon. Furthermore, comparison between leaves with natural inclination and experimental leaves restrained in a horizontal orientation suggest that leaf inclination also plays an important role in reducing photoinhibition. However, these results also showed that both control inclined and experimental horizontal leaves displayed midday photoinhibition, suggesting that there are other mechanisms used by this species to avoid the negative effects of excess sunlight absorption. To determine if the xanthophyll cycle plays a role in the response of this species to high light, xanthophyll pigment concentrations are currently being quantified and will be compared between control inclined leaves and experimental horizontal leaves. The results of this analysis, combined with the results of the investigation of leaf inclination, will elucidate the mechanisms used by *H. bonariensis* in response to high incident sunlight in the sand dune habitat.

1708 - Population Dynamics and Habitat Use of the Buck Darter (*Etheostoma nebra*) in Buck Creek, Cumberland River Drainage, Kentucky

Davy Black

Eastern Kentucky University, Richmond, KY

The Buck Darter (*Etheostoma nebra*) is a recently described fish species confined to the Buck Creek system of Kentucky's Cumberland River Drainage. A survey of Buck Creek by Kentucky Department of Fish and Wildlife Resources personnel found Buck Darters in 2 of 47 historical sites. Individuals were found in two spring-fed tributaries, Big Spring Branch and Stewart Branch, within the entire system. The objectives of this study were to: determine population size and habitat use of Buck Darters at Stewart Branch and Big Spring Branch; and monitor and compare water quality at historical sites and presently occupied streams. Analyses indicate higher abundances of Buck Darters in the mid-reaches of each occupied stream, and no individuals observed in other Buck Creek tributaries. A total of 86 individuals were captured in Stewart Branch and 75 individuals were captured in Big Spring Branch. Based on extrapolated count estimates the population was estimated at around 2000 individuals. Using N-Mixture models to predict abundance based on measured habitat variables and account for imperfect detection the population was estimated closer to 17,000 individuals between the two streams. Important habitat variables associated with their abundance include lower water temperatures and a mixture of substrate size classes resulting in habitat complexity. Results will aid cooperating natural resource agencies in making decisions toward management and conservation of this imperiled species.

1710 - Estimating heritability in thermal tolerance and identifying stress markers that correlate to survival at higher temperatures in *Acropora cervicornis*

Kelsey Yetsko, Matthew Gilg

University of North Florida, Jacksonville, FL

Human activities have substantially increased the atmospheric concentrations of greenhouse gases, resulting in warmer air and ocean temperatures that are having a negative impact on marine ecosystems worldwide. This is a dire threat to reef corals, which have shown recent reductions globally and are susceptible to changes in temperature. Understanding the degree to which species vary in their tolerance to elevated temperatures and whether this variation is heritable is important in determining their ability to adapt to climate change. *Acropora cervicornis* fragments from 20 genetically distinct colonies were kept at ambient and elevated temperatures, and mortality was monitored for 26 days. Time of death was determined by loss of photosynthetic efficiency (Fv/Fm < 200) measured by PAM fluorometry and visually by total loss of coral tissue. Heritability of thermal tolerance was estimated using a clonal method comparing the difference in lifespan within and among clones in a one-way ANOVA, as well as a marker based method using the program MARK (Ritland, 1996) to estimate relatedness between colonies. To understand the physiological basis of thermal tolerance, tissue samples from both treatments were taken after 12 hours to investigate gene expression associated with sub-lethal temperature stress at both the mRNA and the protein level. Variation in mortality following lethal temperature exposure, heritability estimates, and gene expression data will be discussed.

1711 - Metabarcoding Analysis of Cave Prokaryotic Microbiomes in Southwest VA

Brandon Thompson, Robert VanGundy, Bruce Cahoon

University of Virginia's College at Wise, Wise, VA

Caves in carbonate rocks of the temperate Appalachian karst region of the United States host impressive ecosystems comprised of cave-adapted fauna. The primary source of biological energy of these cave systems is unknown but the basis is hypothesized to be prokaryotic organisms. One over-arching mystery is whether the microbes in these caves primarily live outside and enter by way of water flow or form their own endemic communities inside the caves. This project was conducted to begin addressing this by answering two questions: 1 - Does the composition of prokaryotic organisms inside the caves differ significantly from those found immediately outside? and 2 – How similar are the interior cave microbiomes between cave systems? Samples were collected from 4 caves in Lee county VA, and 2 located in Natural Tunnel State Park in Scott County VA. Samples were taken from interior locations where loose sediment accumulated, such as streambeds, from moister clay-like areas, and from the walls. Exterior soil samples were collected immediately outside of the caves with particular attention paid to locations where it was believed water percolated into the caves, as it was hypothesized that this transfer of water could provide a mechanism for prokaryotes to enter the systems. We found 642 OTUs unique to the interior of the caves, 465 OTUs unique to the exterior, as well as 791 OTUs shared between the inside and outside of the caves. This survey provides insight into prokaryotes that inhabit Appalachian karst cave systems and a foundation to study energy generation of these subterranean systems.

1712 - Towards an enhanced chemotaxis assay of *Caenorhabditis elegans* with microfluidics

Sherif Helmey, Robert Grammer

Belmont University, Nashville, TN

The purpose of this study was to construct a simplified microfluidic model for the chemotaxis assay of *C. elegans*. We investigated models with polydimethylsiloxane (PDMS) on glass and PDMS on bacteriological agar. All models were based on a simple design with three bays and two channels connecting the bays in a single row. The current literature affords microfluidic devices that are highly specialized for measuring specific parameters of *C. elegans* while immobilized or mimicking crawling. The method we sought would allow the nematode to crawl only. We hoped to find that our assay was faster, reduces dose dependent effects, and offered a better method for studying chemotaxis with small nematode counts.

1724 - Survival of *Staphylococcus aureus* on ultrasound transducer heads used in healthcare

Henry Spratt, David Levine, Susan McDonald, Sarah Drake, Katherine Duke, Casey Kluttz, Kate Noonan

University of Tennessee at Chattanooga, Chattanooga, TN

Therapeutic ultrasound (US) is commonly used by professions such as occupational and physical therapists for the rehabilitation of soft tissue injuries. US heads come into contact with patient tissues during treatment, putting patients at risk for healthcare acquired infections (HAIs) due to potential cross contamination of the US heads. In this study, a pure culture of *Staphylococcus aureus* was applied to US heads in two ways: 1) mixed into an inorganic matrix (0.85% saline); or, 2) mixed into an organic matrix (tryptic soy broth (TSB)). Time course experiments to assess survival of the *S. aureus* on US head surfaces were conducted by adding known quantities of *S. aureus*, mixed into either of the matrices, to multiple sterilized US heads. Surviving bacteria were removed from the heads using sterile transport swabs at predetermined times (30 & 60 min., 24 hr, and 72 hr), and enumerated via viable plate counts. The results indicate that *S. aureus* in the saline matrix survived only 30 minutes (0.04% of the 2.3e8 cfu initially added), while *S. aureus* applied to the US heads in a TSB matrix survived 72 hr (dropping to 1.9% of the 7.1e7 cfu initially added). These results suggest that within an organic matrix it is possible for *S. aureus* to survive at least three days on the dry surface of a US head. This finding suggests that improperly cleaned/disinfected US heads could contribute to the spread of HAIs associated with *S. aureus*. Additional research on cleaning/disinfection of US heads is warranted.

1730 - Use of High-Impact Practices to Enhance Student Learning in a Tropical Plant Ecology Course.

Aliya Donnell-Davenport

Reinhardt University, Waleska, GA

High-Impact Practices (HIPs) are pedagogical strategies that have been shown to enhance student engagement, improve student learning and increase student retention. Last summer, I incorporated three HIPs into a Tropical Plant Diversity and Ecology course: Global Learning, Undergraduate Research, and Service Learning. Students in the Reinhardt University biology program traveled to Costa Rica for 10 days. Before the trip, they engaged in two weeks of intensive coursework in preparation for what they would experience abroad. Each student was given a neotropical plant family, structural ecosystem characteristic (e.g. epiphytes) or type of interaction (e.g. bat-plant interactions) for which they were entirely responsible during their time in Costa Rica. Students were expected to observe and document their research topic across three ecosystems: rain forest, cloud forest and dry forest. To provide context for their assigned topics, students were encouraged to use the resources available to them in Costa Rica, including interviewing local researchers and guides, and visiting the libraries and herbaria at field stations. As a service learning component, students gathered data for an ongoing climate change monitoring project at La Selva field station and assisted researchers in Monteverde Cloud Forest Reserve with making casts of animal paw prints to help document the mammalian fauna. Upon return, students presented their research findings, as well as their reflections on the trip, to the class. Through the completion of this course, they gained a better understanding of neotropical plant diversity and ecology, gained confidence as young biologists, and were exposed to the world of field research.

1736 - Phenotypic responses of larval spotted salamander to natural and introduced predator kairomones

Christopher Cannon, Jon Davenport

Southeast Missouri State University, Cape Girardeau, MO

Organisms that exhibit phenotypic plasticity are expected to adapt relatively quickly to environmental changes. Numerous studies have found that prey will express adaptive responses when subjected to various predators in experimental settings. For species with a large distribution, such as spotted salamanders (*Ambystoma maculatum*), it is not surprising that phenotypic variance can be high across their range. This variance in response to different predator regimes can lead to local adaptation of populations. While spotted salamanders preferentially oviposit eggs in temporary fishless ponds to decrease egg and larval mortality, Missouri populations will still use permanent fish ponds for reproduction. Using a mesocosm experiment, we investigated how larval salamander oviposition site influenced the behavioral and morphological responses to both native and non-native predator kairomones. For natural predators we used marbled salamanders (*A. opacum*) and bluegill (*Lepomis macrochirus*) and for non-native predators we used the lesser siren (*Siren intermedia*). We found that larval salamanders responded with similar morphological traits to all three predators. However, in the absence of predators, we found statistical variation in head width based upon oviposition site. We also found that behavioral shifts in activity were dependent on predator and oviposition site. Our results suggest that oviposition site may have substantial impact on the degree of phenotypic expression in response to larval predators. Overall, local adaptation may dictate the ability of prey to respond to environmental conditions within a life stage.

1748 - On Teaching Big Ecology: How Do You Maintain Optimism When Teaching a Course on the Future of Human Civilization, and More Importantly, Should You?

Howard Neufeld

Appalachian State University, Boone, NC

I teach a juniors level Honors course titled *The Future of Human Civilization: Climate Change, Population Growth and the Possibilities for Sustainability*. It's not a subject often taught alone by a biologist and as its title suggests, it can be quite depressing at times. However, the course is structured to avoid total negativism because students exposed only to doomsday scenarios may become inured to the potentially devastating implications. I avoid false optimism for its own sake though and discuss options humanity might take to avert global catastrophes in the future. Courses that are too negative become exercises in futility by creating a psychological paralysis that prevents students from considering viable solutions to the world's problems. Although humans have a dismal history predicting future events, teaching a course like this is not a lesson in futility and in fact, I argue that failure to teach such courses represents a moral failure and curricular deficiency on our part as educators. I feel strongly that the near-future (+50-100 years) can be predicted more accurately than in the past because of advances in ecological science and modeling. Higher quality data and computing capabilities that allow analysis of "big data" provide realistic and pragmatic predictions. In this course, students write reflection papers, critique cli-fi novels, discuss scientific predictions of the future, distinguish between human extinction and extirpation, between civilization and society, learn the basics of population growth and climate change, and from these subjects consider whether a sustainable future is possible. Humanity and social science topics are prominently featured throughout. Importantly, we distinguish between the future of humans and that of civilizations, including how the latter may fail. Students gain interdisciplinary exposure to the most important issues facing humanity in the hopes that they will convince their peers that now is the time to act.

1751 - Tracking the spread of *Ficaria verna* (Fig Buttercup) in South Carolina

Jane K. Marlow

SC Native Plant Society & NameThatPlant.net, Travelers Rest, SC

In the Spring of 2013, a significant population of Ficaria verna, formerly Ranunculus ficaria, was discovered in South Carolina. This population extended through 1.5 miles of floodplain

and was the first documented naturalized occurrence of Ficaria in the state. Fig Buttercup, also known as Lesser Celandine, is an attractive, early-blooming garden plant that is relatively little-used in the South, and its aggressive naturalization here was a surprise to many at that time. Immediately a search began to find the source of this infestation, a search that led to another large population on the other side of the state, before ultimately arriving at a residential planting on an unnamed creek five miles upstream from the initial discovery. Ficaria's preferred habitat, phenology, and subspecies distinctions will be discussed in the context of the role each played in this three-year quest, as well as false leads that were avoided. (Ficaria verna has recently been added to South Carolina's list of regulated pest plant species.)

1756 - Reappraisal of the distribution of *Rhododendron* (Ericaceae) in South Carolina

Charles Horn

Newberry College, Newberry, SC

Species within the genus Rhododendron (Ericaceae) were studied for their distributional patterns in South Carolina. The ten documented native species were researched by reviewing herbarium specimens in regional herbaria, including material photographed and posted on the SERNEC website. In addition, multiple field trips were conducted over the last decade to document populations, observe morphological variation, and note habitat preferences. Rhododendron canescens (piedmont azalea) is the most common species, with 370+ specimens observed representing over 260 populations in 32 of the 46 counties. Alternately, R. flammeum is known from only 23 populations in five counties. Rhododendron eastmani (May-white azalea) is the only species endemic to the state and has been documented at 71 population sites in 13 counties. Even though hybrids have been commonly noted in the literature, only one form (R. periclymenoides x atlanticum) has been clearly documented to occur in the state as a collection from Darlington County in 1941.

1758 - John M. Herr, Jr and the Southern Appalachian Botanical Society

Charles Horn

Newberry College, Newberry, SC

John M. Herr, Jr. was elected to fill the position of president of the *Southern Appalachian Botanical Club* (SABC) in 1991. During his three years in office (one year as president-elect, one as president, and one as past-president), he orchestrated substantial changes to the group that help modernize its role as a botanical organization. The most clearly observable change was in the name itself as it officially became the *Southern Appalachian Botanical Society* (SABS), reflecting its expanded mission and geographical scope. Dr. Herr worked to establish new awards, generate a newsletter (Chinquapin), and attain steady growth in the membership. To his credit were changes to the Constitution that updated governance, including a longer term for the president (from three years to four years), the addition of a Membership Secretary to enhance recordkeeping of the membership database, and adding of a first ever set of By-laws to detail responsibilities of officers and committees. Two additional cornerstones of his administration were the establishment of the archives at West Virginia University and the designation of a "type set" for the journal Castanea. Dr. Herr's contributions clearly made a positive and lasting impact on the society.

1771 - Using life history data to examine trade-offs in body size and reproductive ability

Matthew Heard

Belmont University, Nashville, TN

Life history trade-offs provide an opportunity for students to learn about concepts in ecology, evolutionary biology, and natural history. Here, I present a simple activity that I created to help

students use data from museums and online life history databases to explore the relationship between body size and reproductive ability in birds. This activity, which guides students in hypothesis development and testing, data collection, and statistical analysis, is applicable to students at the high school and undergraduate levels. In addition, although I focused on birds, this activity can also be applied to other taxa where life history data are available.

1780 - Assessing local and landscape measures to improve conservation management in the Piedmont Ecoregion

Emma Cook, John Quinn

Furman University, Greenville, SC

Forest fragmentation, resulting from urbanization and population growth, represents a major threat to biodiversity and species abundance. Global forest loss has driven the transformation of contiguous forest biomes to heterogeneous landscapes of urban development, best described as populated forest anthromes. Conservation efforts are often focused on maintaining contiguous forest patches covering large areas, however this may not be sufficient to ensure conservation success in heterogenous urbanized landscapes. As the Piedmont region of the Southeastern U.S. continues on a trajectory of rapid development and expansion, there is an increased need for conservation efforts to protect species and critical lands. Additionally, in order to determine the success of conservation strategies and prioritize conservation actions, multi-scale and comprehensive data are needed. In this study, we assessed bird abundance as a factor of local forest patch structure (e.g., area), land management strategy (e.g., conservation easements, protected areas, etc.), and landscape structure (e.g., matrix composition) at multiple spatial extents. Repeat fixed-radius point counts were conducted across 57 forest patches in Upstate South Carolina. Patch and matrix data were analyzed using ArcGIS and Fragstats. Binomial-Poisson N-mixture models were used to predict abundance. Landscape matrix was shown to be the most important predictor of abundance. We saw no area threshold for abundance among focus species. There was uncertainty surrounding the effects of land management on abundance. These data suggest that consideration of the land use surrounding forest patches is crucial to conserving species in populated forest anthromes. This information can be used to inform decision making about land conservation in Upstate South Carolina and can be applied to improve conservation in temperate forest anthromes.

1794 - The Society of Herbarium Curators—A Dynamic, International Organization with Roots in the Southeastern US

Austin Mast

Florida State University, Tallahassee, FL

The Society of Herbarium Curators formally organized just 14 years ago out of preceding annual activities during the Association of Southeastern Biologists Conference involving John Herr and others. By the end of 2017, the society has grown to 275+ members from 10+ countries. I will discuss exciting recent developments that promise to fuel membership growth further as the world's herbarium collections community recognizes the value of participating in this innovative organization with a laser-focus on the needs of herbaria. Together, SHC's members are building a more resilient, relevant, and responsive herbarium community for the benefit of science and society. SHC values the participation of members from all regions of the world, all institutional contexts, and all career stages.

1797 - SPARC Scholars program yields significant positive effects on some, but not all, measures of STEM undergraduate student success in an at-risk population.

Brooke Bennett-Day[1], Vivia Fowler[1], Holly Boettger-Tong[2]

[1]Wesleyan College, Macon, GA, [2]Wesleyan College, Macon, GA

Retaining potential science and math majors to graduation and subsequent entry into STEM-related fields is a challenge faced by most institutions, regardless of undergraduate student body size. In 2011, Wesleyan College, a small, single-sex undergraduate liberal arts institution, began a program designed to test the hypothesis that intensive faculty advising, upperclass student peer mentoring, financial support and academic "Bootcamp" experiences would have a positive impact on student academic performance, retention to graduation in STEM fields and pursuit of degree-related postgraduate outcomes. The NSF-sponsored SPARC program supported a diverse group of socioeconomically disadvantaged young women (42% African American, 8% Hispanic, 50% Caucasian, average EFC <$500). Outcomes for SPARC Scholars were compared to that of a matched group that did not receive the same kind of intensive programming, but had similar socioeconomic (average EFC of $500 or less) and academic (high school GPA, SAT or ACT scores) profiles. Our data indicate no difference in overall retention to graduation of SPARC Scholars versus the Match population (46% overall SPARC retention versus 50% in the Match population). However, comparing GPA at graduation between the two groups revealed a statistically significant difference between SPARC cohort GPA (3.313) and that of the Match (2.906). In addition, comparison of Organic Chemistry grades of SPARC Scholars versus the Match cohort indicated that SPARC Scholars performed better in this course (but not in Physics) than students in the Match group. Finally, analysis of postgraduate student outcomes (within one year of graduation) suggests that participation in the SPARC Scholars program supported significantly more student entry into major-related graduate schools or major-related work than those who did not participate in the program. Thus, by a number of measures, this program has achieved its goal of supporting diverse, socioeconomically disadvantaged students in degree attainment and in pursuit of STEM-related post baccalaureate outcomes.

1799 - Fire History, the Wildland-Urban Interface, and Future Wildfires in the Southeastern U.S.

Henri Grissino-Mayer[1], Charles Lafon[2], Sally Horn[1]

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The 2016 wildfire season in the southeastern U.S. was particularly active and resulted in unprecedented destruction and loss of life, particularly in and around the gateway tourism communities of Gatlinburg and Pigeon Forge, Tennessee. The Gatlinburg wildfire was fed by a combination of three environmental factors: (1) build-up of fuels over the past 100 years both horizontally and vertically; (2) intense drought conditions that resulted in extremely low fuel moisture amounts; and (3) strong winds from a mountain wave that pushed the wildfires downslope into populated areas. Our research has reconstructed the history of wildfires for the western portion of Great Smoky Mountains National Park and informed us that no wildfire had occurred in the region since the early 1930s. Once the park was established, wildfires ceased to be a major factor that helped maintain the forests of the park. Instead, the park became choked by increasing tree densities, unprecedented growth of understory shrubs, and changed from fire-tolerant tree species to fire-intolerant tree species. All these factors would contribute to any future wildfire event, which likely would be higher intensity than wildfires that had burned in the past. Prior to park establishment, the region had witnessed a major wildfire about once every seven to 10 years, but the park has now gone for decades without any major wildfires due in part to successful fire exclusion and suppression tactics. Two major initiatives must be enacted to mitigate future catastrophic wildfires. First, the National Park Service must be more

aggressive in developing a prescribed fire management policy that focuses on the wildland-urban interface around communities like Gatlinburg and Pigeon Forge, Tennessee; Helen, Georgia; and Cherokee, North Carolina. Second, these communities must educate residents that they live and work in the wildland-urban interface where wildfire risk is particularly elevated.

1803 - The Effects of E-Cigarette Exposure on Lung Cell Viability and Gene Expression

Margaret J. Kovach[1], Christine M. Hale[2], Ethan A. Carver[1], Gretchen E. Potts[1]

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Marketed as a *safer* alternative to tobacco products, the popularity of e-cigarette use is on the rise. However, little is known about the potential health risks associated with their use. Many e-cigarette filling solutions are known to contain significant levels of tobacco alkaloids, including nicotine, anabasine, myosmine and cotinine. Using a panel of lung cell cultures distinguished by differences in sex and disease status, this study addresses the *in vitro* effects of common tobacco alkaloids found in e-cigarettes on cell proliferation and gene expression. We hypothesize that alkaloid exposure of lung cells is associated with abnormal proliferation and gene expression, and predict that cellular response to the alkaloids will present in a sex-specific manner. Alkaloid exposure on each lung cell line was evaluated at 1 µg/mL, 10 µg/mL, and 100 µg/mL concentrations throughout a 10-day time course. Cellular proliferation was measured daily using the CellTiter-Glo® Luminescent Viability Assay, and RNA isolated after 48 and 96-hour time points for gene expression analysis of 10 cancer biomarkers by qRT-PCR. Findings indicate anabasine and myosmine display a significant ($p<0.05$) inhibitory effect on cellular proliferation and gene expression, whereas the effect of cotinine and nicotine was minimal. Each cell line had an inherent, characteristic pattern of cellular proliferation in response to alkaloid exposure. Notably, the cancer cell line demonstrated more variability among replicates, which we attribute to the non-clonal nature of this cell line, and the female cell line displayed increased susceptibility to toxicity by the higher alkaloid concentrations. Significant differences in gene expression ($p<0.05$) were noted for oncogenes *AHR*, *CEACAM6*, *CYP1A1* and *MDM2*, tumor suppressor gene *TP53*, and cancer related antioxidant genes *ALDH3A1* and *GPX2*. Correlation of abnormal patterns of cell proliferation and differential gene expression with risk for disease are discussed.

1804 - John M. Herr, Jr. at the University of South Carolina: a legacy.

John Nelson

University of South Carolina Herbarium, Columbia, SC

John Mervin Herr, Jr. (1930-2016) was Distinguished Professor Emeritus in the Department of Biology at the University of South Carolina. He graduated from the University of Virginia with BA and MA degrees, from the University of North Carolina with a Ph.D. in botany, and served a post-doctoral appointment at the University of Delhi, India, on a Fulbright Fellowship (1957-58). He accepted a faculty position with the Biology Department at the University of South Carolina in 1959, retiring “officially” in 1993. During his 34 years of service at USC, he perennially proved to be a devoted part of the “human campus”, serving on many committees, and tirelessly engaged as a member of the faculty senate, meticulously devising a modern framework for its protocol and activities. Locally, he was a champion of USC’s biology program and cultural offerings, and he had many graduate students. Internationally, he was regarded as one of the world’s premier plant morphologists, publishing many scholarly works. After retirement, he maintained his office, arriving at work regularly and promptly (without the advantage of a permanently reserved parking spot). In the early 1990s, he focused considerable attention on the A. C. Moore Herbarium at USC, recognizing the interplay between physical collections and electronic data harvest. He ingeniously devised an active Endowment (named in honor of Wade T. Batson) for the Herbarium; this Endowment

maintained through the University's Foundations. The Consortium of South Carolina Herbaria was established under his direction. He expanded this vision regionally by spearheading a formal development of the constitution and by-laws of the Society of Herbarium Curators, now flourishing in large part due to his work. Although he would never have claimed to be a taxonomist, he deserves an honored place among plant taxonomists as a cherished luminary.

1809 - WeDigFLPlants—Innovative, place-based citizen science engagement to build the most complete historical baseline possible for Florida's plants

Austin Mast

Florida State University, Tallahassee, FL

WeDigFLPlants is a collaboration between herbaria, enthusiast groups (such as the Florida Native Plant Society), classrooms, and others to transcribe herbarium specimen labels from all remaining non-databased, Florida-collected specimens no matter where in the world the specimens are curated. Since its start in 2016, WeDigFLPlants has produced about 50,000 transcriptions by combining the infrastructure and other resources of Biospex.org, NotesfromNature.org, WeDigBio.org, iDigBio.org, and the Libraries of Life Augmented Reality Mobile App to create an engaging and educational experience for participants. I will provide an overview of how the cyberinfrastructure pieces fit together and how their new developments are likely to benefit WeDigFLPlants and other projects like it in the southeastern US, such as in Arkansas and Virginia.

1810 - *Investigating causes of ontogenescence by examining barnacle hatching success*

Brennan Fitzgerald, M. Chase Freeman, Paul Dunn

Georgia Southern University, Savannah, GA

Most organisms experience ontogenescence (high and decreasing mortality from conception to the age of maturity) in spite of the clear evolutionary disadvantage of dying prior to reproducing. Despite its clear importance to the evolution of life, ontogenescence remains a largely understudied subject. One hypothesis that may help to explain the prevalence and persistence of ontogenescence is the Transitional Timing Hypothesis, which states that developmental transitions are dangerous and concentrated in the earliest phases of life (e.g. hatching or birth). This study's goal was to examine the transitional dangers of hatching in the model organism *Chthamalus fragilis*, an estuarine barnacle. Barnacles were collected from local saltmarsh grass and brought to the lab where egg sacs were dissected out and stored in well plates. Egg sacs were monitored for two weeks, and all hatching events were recorded along with whether each hatched larva was a successful swimmer or not. The total number of eggs that failed to hatch from each egg sac was also determined. Results indicated clear patterns in the timing of hatching events and the proportion of larvae that could swim well after hatching. The relatively high number of non-swimming hatchlings as well as the significant proportion of eggs that failed to hatch lend support to the Transitional Timing Hypothesis, suggesting that birth in barnacles (and probably many other organisms) is a potentially dangerous event that cannot be avoided.

1811 - Swimming kinematics of loggerhead sea turtles during their first year of life

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Sea turtles embark on extensive transoceanic migrations during early ontogeny, often moving into and out of prevailing currents in search of target food sources. Although efficient swimming is essential to a turtle's survival during early development, surprisingly little is known about sea turtle swimming capabilities during the critical first year of life. In this study, we

examined swimming kinematics of loggerhead sea turtles *Caretta caretta* through their first year of life, with an emphasis on documenting (1) sustained swimming speed capacity, (2) stability, and (3) flipper motions. Each of four post-hatchling loggerhead sea turtles was placed in a 1000-gallon water tunnel at 3, 4, 5, and 6 months of age and subjected to a stepwise increase in current speed while three high-speed digital video cameras simultaneously recorded their swimming motions. Landmarks on the turtle flippers and shell were tracked using motion analysis software, and parameters such as pitch, roll, yaw, stroke amplitude, stroke arc angle, and stroke frequency were measured. Critical swimming speed ranged from 13 to 20 cm/s for turtles 3-6 months of age. Turtles achieved higher swimming speeds by increasing the frequency, vertical arc angle, and horizontal amplitude of their foreflipper strokes. Body pitch angle decreased with increased swimming speed, but body roll and yaw did not change significantly with increased swimming speed. Pitch, roll, and yaw decreased with ontogeny, suggesting that sea turtles improve their swimming proficiency with age and/or with experience swimming in the water tunnel. No abrupt kinematic shifts indicative of gait transitions were observed across the speed range tested. Rather, the turtles made gradual adjustments to their flipper motions and body positioning to achieve higher swimming speeds. Data from this study can be applied to oceanic current models and satellite tracking data to better understand sea turtle global movements.

1813 - MultiEDA: An interactive exploratory data viewer for multivariate plot-based inventory data

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With the growing size of ecological datasets, it has become operationally difficult to quickly and effectively examine data in exploratory phases of research. This is especially true regarding visual examination of complex data, such as those pertaining to multivariate plot-based inventory studies. Continuous improvements in computing technologies have led to the development of numerous tools for analyzing complex data, but few user-friendly interfaces designed specifically for multi-faceted exploratory visual analyses of large, multivariate data have been available. “MultiEDA” is an interactive web application implemented in the Shiny package of R that provides an extensive yet succinct and user-friendly interface for visually examining trends in multivariate plot-based species data. The viewing tool uses a tabular setup to quickly move between raw data tables, ordination plots, clustering analysis fits, indicator species tables, size distribution diagrams, and plot layout histories. Each of these functionalities is interactive, with each visual output providing the user a series of control buttons to update visualizations in real time. For example, MultiEDA allows the user to visualize NMDS ordinations with the ability to change input data, select clustering assignment of points, zoom in and out, customize plot labels, reverse axis directions, include change vectors, highlight specific trends, save output as images, and interact with the data itself. This type of user-friendly and interactive data viewing tool can make exploratory data analyses for complex data much quicker and more straightforward. Instead of opening multiple output files or printing various iterations of a plot or graph, MultiEDA lets the user manipulate data output in real time to quickly examine and compare trends. MultiEDA can simplify and expediate exploratory data analyses for a wide range of ecological and environmental multivariate data.

1815 - Isolation of Lysosomes in *Caenorhabditis elegans*

Ryan Fox, Robert Grammer

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In this experiment, we aimed to accomplish the isolation of lysosomes within the model organism *Caenorhabditis elegans*. In an effort to obtain this isolation, a protocol used for the isolation of mammalian lysosomes was adapted for *C. elegans* in addition to growth of the

worms in liquid culture. This turned out to be successful. To ensure both viability and efficiency of the isolation, assays involving Acid Phosphatase, a marker enzyme for lysosomes. Protein content was measured, and subsequently specific activity of the lysosomes was obtained. These values were then used to construct a de Duve plot. Finally, the pH dependency of the samples was determined using Acid Phosphatase assays conducted in varying pH buffers ranging from 3 to 11.

1816 - Taxonomy of *Diervilla* P. Miller (Bush-honeysuckle; Caprifoliaceae)

Kathy Mathews, Hannah Meeler

Western Carolina University, Cullowhee, NC

Diervilla comprises three species of flowering shrubs in eastern North America, which together with the Asian *Weigela* form a dry-fruited clade in the Caprifoliaceae s.l. We explored morphological and molecular variation within and among *Diervilla* species with the goals of 1) better delimiting species based on morphology and ecology, 2) clarifying their geographic ranges, and 3) resolving relationships among them. Field observations and collections were made in western NC and northwestern GA. Herbarium specimens from throughout the southeast were examined and measured. Specimens were sometimes misidentified, possibly misleading previous hypotheses of species ranges. We performed Principle Components Analysis on morphological and environmental characters. Pubescence and petiole length clearly separated Southern Appalachian samples into three species, but not with broader sampling, indicating increasing variation with geographic area. Only inflorescence congestion remained constant across species ranges and could be used to distinguish *D. lonicera* from the other two. We sequenced the nrITS region and multiple noncoding cpDNA regions in multiple individuals from each species. ITS sequences showed autapomorphies that distinguished each species but could not resolve relationships among them. cpDNA sequences showed surprisingly low amounts of variation and poor phylogenetic resolution, suggesting recent divergence and/or historical gene flow among species. *Diervilla sessilifolia* Buckl. is a Southern Appalachian endemic inhabiting a range of elevations and encompassing much vegetative variation. *Diervilla rivularis* Gatt. may be restricted to the southernmost Cumberland Plateau region in TN, AL and GA, and is distinct from *D. sessilifolia* based on pubescence and ITS autapomorphies. *Diervilla lonicera* P. Miller has the broadest distribution, extending north into Canada, and is a high-elevation species in the Southern Appalachians. Based on morphological similarity and range proximity, *D. sessilifolia* and *D. rivularis* may be sister species. Broader geographic sampling, coalescence-based species delimitation, and historical population expansion-contraction analyses are warranted to confirm these conclusions.

1819 - Stress mediates community assembly processes in coastal ecosystems

Joseph Brown, Julie Zinnert

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Coastal ecosystems are driven by variable climatic and atmospheric disturbances. However, questions regarding plant community assembly patterns in these systems have accrued little focus. More information may be drawn about community assembly patterns by investigating species and functional components of variability on islands differing in disturbance. Stochastic processes (e.g. Neutral theory) are often associated with productive environments, while deterministic processes (e.g. Niche theory) are primarily important in harsh, less productive habitats. Coastal communities are considered to be harsh environments, however variable topography and vegetation patterns result in a mosaic of habitats. Coastal landforms with topographic complexity may exhibit higher stability, diversity, and productivity whereas those with lower, flatter topography experience more disturbance resulting in a harsher, less stable environment. Our objective was to use species and functional metrics to investigate community

assembly patterns on two islands with differing disturbance regimes. We propose that exposure to stress mediates dominant community assembly processes, with stable, highly productive island landscapes driven by stochastic processes whereas stressed, less productive sites will be constrained by deterministic processes. Low disturbance sites had higher productivity (538 g m^{-2}) compared to high disturbance sites (358 g m^{-2}), however disturbance regime had minimal effect on species composition. We found limited differences in community-weighted functional traits (e.g. specific leaf area, plant height) between disturbance regimes. Investigation of communities within islands (i.e. dunes, swales) showed higher inter-community functional variability at high disturbance sites and lower variability at low disturbance sites. Results suggest community assembly processes within islands could be mediated by stress levels associated with disturbance regime. Stochastic processes are more important in sites with lower disturbance and higher productivity, while deterministic processes influence community assembly in high disturbance areas. These results have implications on how coastal ecosystems may respond as storms and associated disturbance events increase in frequency and intensity.

1832 - Characterization of the protein-protein interactions associated with the plastid-encoded factor Maturase K

Alexandra Margets, Michelle M. Barthet

Coastal Carolina University, Conway, SC

Many associate a spliceosome, a multi protein and RNA complex required for the splicing of introns, to the nucleus of eukaryotic cells, but evidence suggests that the chloroplast of land plants may also contain its own specialized spliceosome. Group IIA introns of the chloroplast have been postulated to be excised by both nuclear encoded factors such as the ribonuclease III protein (RNC1), and What's the Factor 1 (WTF1), as well as plastid-encoded factors, specifically Maturase K (MatK). We have initiated a series of co-immunoprecipitation studies to assess the protein-protein interactions between MatK and splicing factors of chloroplast group IIA introns. Collective data will be used to devise a model of group IIA intron splicing processes in the chloroplast of land plants.

1834 - The Right Place at the Wrong Time: Maximizing Detection in Surveys of Green Salamanders (*Aneides aeneus*)

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Green Salamanders (*Aneides aeneus*) are secretive plethodontids that prefer deep crevices in vertical rock outcrops as refugia. These microhabitat preferences make surveying for Green Salamanders difficult relative to traditional herpetofaunal inventory methods, with visual encounter surveys often the only effective means of assessing populations. However, this also means that issues stemming from imperfect detection may be pronounced for this species, particularly given Green Salamanders' proclivity for dispersing into arboreal habitats adjacent to rock outcrops. We used data from a multi-year study of an abundant Green Salamander population distributed across the Cumberland Mountains and adjacent regions of Kentucky, Tennessee, and Virginia to examine detection relative to local weather conditions, seasons, and time of day. We found that detection for outcrop-based surveys was strongly tied to both moisture levels and time of day, with detection lower during and immediately after rainfall events and during nighttime surveys. Mark-recapture data suggest that these differences were due to the dispersal of salamanders away from crevice refugia and rock substrate, with the number of encountered salamanders ranging from more than 100 per hour to zero at the same site throughout the study period when using outcrop-based survey methods. These results suggest that typical desirable periods for lungless salamander surveys (warm, rainy or humid

nights) may actually overlap with conditions that minimize Green Salamander detection and impede the effectiveness of outcrop or crevice-based surveys. We will provide recommendations for enhancing survey design, including ways to improve detection in arboreal habitats adjacent to rock outcrops.

1840 - Impact of Hurricane Matthew's storm surge on forests still recovering from Hurricane Hugo at the marsh-forest boundary in coastal South Carolina

Stefanie L. Whitmire[1], Thomas L. O'Halloran[1], Thomas Williams[2], Bo Song[1], Skip Van Bloem[1], William Conner[1]

[1]Clemson University, Georgetown, SC, [2]Baruch Institute of Coastal Ecology and Forest Science, Georgetown, SC

In 1989 Hurricane Hugo made landfall just north of Charleston, South Carolina as a category 4 storm. It caused moderate to severe damage in coastal forests from Beaufort to Myrtle Beach and destroyed nearly one billion board feet of timber in Francis Marion National Forest. Researchers at Clemson's Baruch Institute established a series of long-term forest research plots to monitor forest recovery and quantify potential demographic shifts in species composition. A series of plots were established at Hobcaw Barony, just outside Georgetown, 80 km north of landfall where winds likely gusted to 50 m/s and trees were nearly completely destroyed by wind and a 2.7 m storm surge. Forest biotic surveys have been conducted every 3 years in these plots since 1994. In 2016 the eye of Hurricane Matthew passed over these plots as a category 1 hurricane, and pushed an approximately 2-m storm surge several decimeters into the forest. The long-term Hugo recovery plots experienced a mix of surge severity, ranging from zero inundation to complete inundation. This presentation includes initial results from an NSF RAPID project designed to capture the soil salinity dynamics following Hurricane Matthew, and to develop a baseline dataset of overstory and understory tree demographics, so that potential salt-induced mortality can be tracked forward in time. Repeat canopy photography using multispectral imaging via unmanned aerial vehicle (UAV) was also established to track canopy mortality. After one year, results indicate that mortality was modest, and confined to lower elevation drains where salt may have been more concentrated. Small patches of beetle infestations have recently been discovered in presumably salt-stressed trees in the surge zone, and their progress is being monitored

1843 - Plastid phylogenomic analysis of green plants: a billion years of evolutionary history

Matthew Gitzendanner[1], Pamela Soltis[1], Gane Wong[2], Brad Ruhfel[3], Douglas Soltis[1]

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For the past one billion years, green plants (*Viridiplantae*) have dominated global ecosystems, yet many key branches in their evolutionary history remain poorly resolved. Using the largest analysis of *Viridiplantae* based on plastid genome sequences to date, we examined the phylogeny and implications for morphological evolution at key nodes. We analyzed amino acid sequences from protein-coding genes from complete (or nearly complete) plastomes for 1879 taxa, including representatives across all major clades of *Viridiplantae*. Much of the data used were derived from transcriptomes from the One Thousand Plants Project (1KP); other data were taken from GenBank. Our results largely agree with previous plastid-based analyses. Noteworthy results include (1) the position of Zygnematophyceae as sister to land plants (*Embryophyta*), (2) a bryophyte clade (hornworts, mosses + liverworts), (3) *Equisetum* + Psilotaceae as sister to *Marattiales* + leptosporangiate ferns, (4) cycads + *Ginkgo* as sister to the remaining extant gymnosperms, within which *Gnetophyta* are placed within conifers as sister to non-Pinaceae (Gne-Cup hypothesis), and (5) *Amborella*, followed by water lilies (Nymphaeales), as successive sisters to all other extant angiosperms. Within angiosperms, there is support for *Mesangiospermae*, a clade that comprises magnoliids, Chloranthales,

monocots, *Ceratophyllum*, and eudicots. The placements of *Ceratophyllum* and Dilleniaceae remain problematic. Within *Pentapetalae*, two major clades (superasterids and superrosids) are recovered. This plastid dataset provides an important resource for elucidating morphological evolution, dating divergence times in *Viridiplantae*, comparisons with emerging nuclear phylogenies, and analyses of molecular evolutionary patterns and dynamics of the plastid genome.

1844 - Impact of land use on the formation potential of disinfection by-products along the Yadkin-Pee Dee River basin under 2016 Hurricane Matthew

Huan Chen, Hamed Majidzadeh, Alex Chow

Clemson University, Georgetown, SC

Hurricane extreme events have reported to alter the quantity and quality of dissolved organic matter (DOM) dramatically. Thus, the formation potential (FP) of disinfection by-products (DBPs) can also be changed significantly. Until now, most of the studies are focused on one or two sites at coastal area and the impact of land use on the FP of DBPs has been ignored. Here, we collected the samples along the Yadkin-Pee Dee River basin during 2016 Hurricane Matthew for the impact of land use on the FP of two carbonaceous (THM and HAA) and two nitrogenous (HAN and NDMA). We found the percentage increases of studied DBPs were HAN (356.5 %) > NDMA (246.4 %) > THM (115.2 %) > > HAA (1.5 %). The FP of THM, HAA, and HAN was positively related to the area percentage of wetland during the high flow condition, while the FP of NDMA was positively correlated with the area percentage of urban. The change of disinfectant from chlorine to chloramine decreased the THM FP by 78.6 ± 8.3% but increase the HAN FP by 54% during high flow conditions. The results of this study high lights the importance of controlling DOM quantity and composition during the hurricanes, especially in areas with large wetland or/and urban areas.

1846 - Understanding the interaction of vegetation, soil, and ant communities

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Ants are common organisms that are often used to monitor diversity and conditions in the community because they are sensitive to environmental disturbance and soil quality. Plants are very important in this study because their diversity can influence organisms by changing the resource availability, structure and abiotic conditions of the environment. There is a general agreement between ants and plants because they are also known to disperse seeds of certain types of plant. Several studies have found that seed-dispersing ants are important for plant diversity, however, the role of plant diversity and vegetation complexity on ants remains unresolved. Our aim was to determine: 1) The role of vegetation on abiotic conditions (moisture, available sunlight, canopy cover) and 2) How vegetation structure and diversity (height/density) affects ant diversity. We established 20 sampling plots ($10m^2$) where we characterized the plant community (richness and abundance), vegetation structure (height, density, canopy cover), soil variables (texture and moisture), and ant community (richness and abundance). When all the data were collected we did general linear models to determine the relationships between the ant, plant and soil variables. In our results, we had an ant abundance of 289, 20 ant species and 72 plant species found. Ant abundance and richness were negatively affected by soil moisture (especially in flooded areas), but positively affected by vegetation cover. Plant richness was negatively affected by soil moisture and vegetation cover was negatively affected by canopy cover. Soil texture did not appear in any of the best models. We came to the conclusion that canopy cover drives vegetation cover which affects the ant diversity, and both plants and ants are negatively affected by very moist soil conditions.

1847 - Assessing the Fire History of Pilot Mountain State Park in North Carolina

Dane Kuppinger

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In some ecosystems, fire has a large influence on the types of vegetation present. Determining the historical fire regime can help explain current vegetation patterns and aid future planning and management. This study utilized fire scars on three pine species (Pinus pungens, P. rigida, and P. virginiana) to assess the fire history of Pilot Mountain State Park. It was hypothesized that the fire history of Pilot Mountain would closely resemble that of previously studied xeric forests of the southern Appalachians. Fifty-two cross-sections were analyzed and a composite fire history was constructed from these samples. Samples were dated visually and the accuracy of dates was cross-checked utilizing the program COFECHA. Forty of the collected samples exhibited fire scars and between them they contained 61 fire scars covering the years between 1858 and 2014. Fire frequency was greatest between 1900 and 1932 with 16 distinct fires recorded within this period, 11 of which were recorded by more than two trees. The Mean Fire Interval (MFI) of these samples was 3 years, but this was highly influenced by clustered fire events, particularly between 1935 and 1995. The MFI for Pilot Mountain was shorter than what has been found in previous studies in the Appalachians potentially indicating a greater degree of human influence in this community than has been seen in larger, more remote xeric Appalachian forests.

1848 - Forensic Ecology: The Role of Invasive Species in Estimating “Time of Death”

Ed Mondor

Georgia Southern University, Statesboro, GA

Insect evidence is increasingly being used to determine the “time of death”, or postmortem interval, of human decedents. As such, it is important to gain a better understanding of the factors influencing insect attraction to, and development in, vertebrate remains. But what role does ecology play in helping us better understand, and refine, postmortem interval estimates? In this talk, I will outline how an invasive species, The Oriental Latrine Fly, *Chrysomya megacephala* (Diptera: Calliphoridae), played a key role in a death scene investigation in Southeast Georgia. In sum, this talk will provide a better understanding of how the emerging field of forensic ecology can aid in refining postmortem interval estimates in law enforcement investigations.

1858 - *On the effectiveness of illustration in modern botanical keys*

Andi Kur, Joey Shaw

University of Tennessee at Chattanooga, Chattanooga, TN

The two-thousand-year history and development of botanical illustration has been highly intermeshed with the development of descriptive botany; however, with the more recent professionalization of botanical science, the continued utility of illustration has been little reconsidered, despite the benefits that modern technology has conferred onto the practice. Recognizing this, the purpose of our research was to reassess potential benefits of illustration in modern botanical keys. At the outset, we compared the use of illustration to photography for the presentation of visual references. Then, we formulated ideas on how illustration itself may be best employed for most effective use within keys, and we used these ideas to inform the drafting of 95 new illustrations for the 2nd edition of the *Guide to the Vascular Plants of Tennessee*. The results of our research and practical exercise in drafting ultimately suggest that: (1) visual references are beneficial to the effectiveness of dichotomous keys, (2) illustrations stand to be more effective than photographs for the presentation of these visuals, and (3) the effectiveness of illustrations is highly contingent upon the content of the drawings

and on the context in which they are used within the text. Finally, we lay out guidelines to be employed in the effective drafting and use of illustrations in modern botanical keys.

1869 - A Preliminary Vascular Plant Flora of the Bare Zone of the Copper Hill Basin, Polk County, Tennessee.

John Shelton, Joey Shaw

University of Tennessee at Chattanooga, Chattanooga, TN

In Polk County Tennessee, in the Southern Blue Ridge ecoregion, there exists a 10,000-acre area known as the Copper Hill Basin. This basin was mined for copper in the late 1800s and early 1900s. The effects of the processing of this material were incremental, leaving three distinct zones: a "forested zone" outside of the immediate impact caused by mining, a "grassy zone" where woody plants were entirely extirpated and only tuft forming grasses like *Andropogon virginicus* and *A. gerardii* were found, and a "bare zone" where little to no vegetation occured. Historically, the "bare zone" was described as being "Mars-like" for its characteristic red, barren soils. Since the mining was halted in the 1920's, much of the grassy and bare zones have become revegetated, due in large part to plantings of virginia and loblolly pine by the Tennessee Valley Authority. However, many species have also come into these areas naturally and create an interesting area for floristic study. To date, 224 species in 116 genera, representing 94 families have been documented. Surprisingly, there are seven rare or conserved species. In addition, new techniques in floristic data collection are analyzed as a tool for comparison for the collections of the Copper Hill Basin.

1871 - Chlorophyll dynamics at high-energy beaches

Angelos Hannides

Coastal Carolina University, Conway, SC

High-energy sandy beaches are sites of significant exchange between water and sediment. This enhanced exchange is attributed to the high permeability of sandy sediment columns, which permits physical forcing (from waves, tides and currents) to distribute regenerated nutrients from great depths to the euphotic sediment surface, where they can fuel microphytobenthic productivity. The result is a rich food web which includes, for instance, abundant invertebrate communities that sustain many shorebird species. Moreover, sandy beaches may act as biofilters by intercepting and filtering land-derived nutrients, thus ameliorating water column eutrophication and hypoxia. It is therefore important to examine the understudied and potentially important role of microphytobenthos on high-energy beach habitats. Our study documents spatial and seasonal patterns in Chlorophyll *a* concentrations at several open-faced high-energy sandy beaches in Long Bay, South and North Carolina. Data from a monthly time-series at Waties Island, SC, demonstrates that water-column peaks in Chlorophyll a during blooms propagate several decimeters into the shallow subtidal sediment column at higher concentrations, indicating deep mixing of this column on the scale of days to weeks. Runnels that typically form at gentler-sloping beaches during low tide are relatively quiescent. Subsequent low sediment mixing and high water clarity allow microphytobenthic biofilms to develop rapidly and form patches of significantly elevated Chlorophyll *a*. Patchiness is often associated with runnel ripple crests that may receive more light than ripple troughs, or at locations of selective nutrient-rich pore water emersion during tide ebb. Data from sites across Long Bay illustrates similar deep repositories of Chlorophyll a within shallow subtidal sediment columns that may vary in intensity and pattern with depth depending on sedimentary permeability. The above patterns suggest that high-energy beaches may be a site of substantial and dynamic primary productivity that can sustain higher trophic levels and are therefore deserving of further investigation.

1880 - Predator and Prey Behavior in Two species of Tardigrade

Harry Meyer, Nézira Akobi

McNeese State University, Lake Charles, LA

The behavior of water bears (Phylum Tardigrada) has only rarely been studied; the few investigations that have been conducted have focused on the response of tardigrades to environmental variables. In tardigrades, vision is unlikely to be important in hunting prey or avoiding predation in tardigrades; detection of other animals more likely involves physical contact or olfaction. We investigated whether predatory tardigrades are attracted to, and potential prey avoid, areas previously occupied by another species. We used two species of tardigrade found in southwestern Louisiana. *Milnesium lagniappe* is a large tardigrade that preys on nematodes, rotifers, and small tardigrades like *Macrobiotus acadianus*. Petri dishes with non-nutrient agar were used as experimental chambers. To test whether *M. lagniappe* was attracted to agar areas previously occupied by *M. acadianus* we allowed 21 *M. acadianus* to roam over half of a petri plate for 20 hours, leaving the other half free of *M. acadianus*, removed them, and added 24 *M. lagniappe*. After 20 hours *M. lagniappe* were significantly concentrated in the area previously occupied by *M. acadianus*. In a control treatment without *M. acadianus*, *M. lagniappe* were randomly distributed. A similar protocol was used to test whether *M. acadianus* avoided areas previously occupied by *M. lagniappe*. After 20h M. acadianus were significantly concentrated in the area never occupied by *M. lagniappe*; the control distribution was random. These results suggest that both species can detect the other without physical contact and react accordingly.

1883 - Drivers of Bird-Dispersed Exotic Plant Species in the Southeastern United States

William Sipek, Loretta Battaglia

Southern Illinois University, Carbondale, IL

Exotic plant species degrade ecosystems that lack their natural predators and competitors. These invasives often have high growth rates and proliferate rapidly after colonizing habitat openings created by disturbances. Several species produce fleshy fruits and are spread by frugivorous birds, replacing native fruit in their dispersers' diets and forming mutualistic relationships with local frugivorous fauna. If fruit-feeders forage on multiple plants then these plants may indirectly affect the dispersal of fellow fruit-producers through contagious dispersal, allowing facilitative relationships to form between various native and exotic plant species. This study aims to answer two questions: (1) How do disturbance regimes impact the growth and spread of *Triadica sebifera*, a common exotic tree in the Southeast United States? (2) How do native and exotic plant species affect the contagious dispersal of native and exotic plants. The study sites are located in the Grand Bay National Estuarine Research Reserve (GBNERR) in coastal Mississippi and in the Weeks Bay National Estuarine Research Reserve (WBNERR) in coastal Alabama. At both sites, samples of *T. sebifera* were cut in order to determine the impacts of known disturbance events (wildfires and tropical storms) on the growth and recruitment of this tree through the study of its growth rings. Seed traps have been set up underneath specimens of *T. sebifera*, one fellow exotic fruit-producing species (*Cinnamomum camphora*), and three native fruit-producers (*Morella cerifera*, *Ilex vomitoria*, and *Persea borbonia*). The identification of the scarified seeds in these traps will reveal potential contagious dispersal between the focal species. Preliminary analyses indicate that recruitment of *T. sebifera* is most prevalent following severe tropical storm events (e.g. Hurricane Katrina). It also appears that the spread of native species is dominant in this ecosystem regardless of the plant species acting as a hub for contagious dispersal.

1889 - Genetic variability among populations of *Chamaecrista fasciculata (Fabaceae) occurs at small spatial scales* in the Southeastern U.S.

Mahboubeh Hosseinalizadehnobarinezhad[1], Lisa Wallace[2]

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Studies of population genetic structure enable understanding of how environmental factors influence gene flow and local adaptation. Widely distributed species are ideal systems for understanding local changes because they occupy diverse habitats and experience varied interspecific interactions that could lead to the evolution of adaptive variation. *Chamaecrista fasciculata (Fabaceae) has a wide geographic range in the eastern U.S., extending from Minnesota to the Gulf Coast and from the east coast to New Mexico.* Regional morphological and ecological variants are commonly recognized in this species, and past studies have shown that populations in the Southeast exhibit greater morphological variability than those in other areas. Some studies have identified local adaptation among widely spaced populations, but few studies have surveyed southernmost populations. To gain a better understanding of intraspecific variation across geographic space for this species, we collected data at 14 microsatellite loci from samples in twenty six populations in the Southeast. We hypothesized that populations would be genetically structured, following an isolation by distance pattern. Genetic diversity was high across populations (mean percent polymorphic loci = 95%; Ho = 0.495; He = 0.526). Analysis of molecular variance indicated that variation is partitioned within individuals (62%), among individuals within populations (25%) and among populations (13%). Additionally, a significant correlation between genetic and geographic distance was found in a Mantel test (R = 0.29, p = 0.00232). A Mantel correlogram revealed non-significant correlations at the shortest and largest distance classes, but significant positive correlations at intermediate distance classes (50 to 130 Km). Latitude, but not longitude, was found to be a significant factor in explaining the observed pattern of population differentiation, which suggests range expansion along a latitudinal gradient. These results suggest considerable genetic structure among populations of *C. fasciculata and potential for local adaptation* in a relatively small geographic area.

1893 - Characterizing Phenotypes Associated with Glyphosate Resistance in *C. elegans*

Natalie Gauger, Daniel Williams

Coastal Carolina University, Conway, SC

Glyphosate is a compound found in many broad-spectrum agricultural herbicides. Despite the wide usage of glyphosate-containing herbicides, the impact of glyphosate on human and environmental health is not well established. The glyphosate containing herbicide, Touchdown, shows dose dependent toxicity to the nematode C. elegans. We obtained a strain of worms that shows resistance to Touchdown, the LC80 strain. Our study examined glyphosate resistance, developmental, and reproductive phenotypes of this strain compared to wild-type worms. In contrast to wild-type, LC80 animals are resistant to levels of Touchdown that correspond to 5% glyphosate. Developmental discrepancies were quantified by observing progression through different developmental larval stages and indicate LC80 animals develop precociously. LC80 animals have fewer offspring and show egg-laying defects that are associated with reproductive abnormalities. Our results suggest that long-term exposure to glyphosate can lead to resistance associated with developmental and reproductive defects.

1899 - Arboretum development on the campus of Southern Adventist University

Michael Baranda, Benjamin Thornton

Southern Adventist University, Collegedale, TN

Arboreta provide communities with opportunities to learn about and grow in appreciation of tree and shrub species. This increased appreciation can help foster conservation efforts of native species. Establishing a horticultural plan for an arboretum requires baseline data including the identification and number of all representative species. In this study, species richness and abundance of all trees on the main campus of Southern Adventist University (SAU) located in Collegedale, Tennessee was determined in order to develop a horticultural plan to increase the diversity of native species. Trees were tagged with a specific number and diameter at breast height (DBH) was measured. High-precision global positioning system (GPS) was used to establish the location of each tree. This information was used to create a map with layers for each species. Species abundance and diversity were compared to the same for the arboreta at the University of Tennessee at Chattanooga (UTC), Vanderbilt University (VU), and East Tennessee State University (ETSU). We identified a total of 1,003 trees on our campus which included 76 species. Nineteen species were represented by only one individual each. *Tsuga canadensis* (Eastern Hemlock) was the most abundant species with 142 trees. Of the 76 species, 45% (n=34) were native to Tennessee as compared to 41% (n=26) at UTC, 39% (n=66) at VU, and 22% (n=45) at ETSU. The horticultural plan is presented in this study.

1907 - Examining treehopper maternal vibrational signals during simulated predator attacks

Breanna Coughlin, Jen Hamel

Elon University, Elon, NC

Aggregating, plant-feeding insects play key roles in ecosystems as herbivores, prey, and as mutualists with other insect species. The behavioral mechanisms by which such insects avoid predation and maintain mutualisms can include communication by substrate vibrations. In some species of treehoppers (Hemiptera: Membracidae), females produce vibrational signals when defending offspring from predators, and in at least one species, female signals appear to recruit ant mutualists. Female keeled treehoppers (Entylia carinata) defend offspring during simulated predator attacks, and the presence of females and ants increases offspring survival in the field. However, vibrational signals have not been characterized for this species, and it is unknown whether females produce vibrational signals during predator attacks. Here, we first described Entylia female vibrational signals, which contain four components that differ in temporal and spectral parameters. We then asked whether female Entylia with eggs or offspring signal in response to simulated predator attacks. Because E. carinata occurs on multiple host plant species, we measured the responses of females from two different hosts. Female Entylia produced many more vibrational signals during simulated predator attacks than during control treatments, and this response did not differ according to host plant species (lmm, predator vs control: $\chi 2 = 34.202$, $P < 0.001$; host plant: $\chi 2 = 2.629$, $P = 0.105$; interaction term: $\chi 2 = 1.158$, $P = 0.282$). Because almost all females on both host plant species produced vibrational signals during simulated predator attacks, we suggest that such signals promote juvenile and/or female survival, perhaps by maintaining juvenile aggregations or attracting ant attendants.

1913 - Long-term Response of Forests Disturbed by Hurricane Hugo in the Coastal Plains of South Carolina, USA

Reid Heaton[1], Bo Song[2], Charles Gresham[2], William Conner[2], Thomas Williams[3]

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In 1989, Hurricane Hugo inflicted catastrophic damage on approximately 1.8 million hectares of forested land in South Carolina. This study's purpose was to monitor species compositional shifts and structural changes in several forest types following the disturbance from Hurricane Hugo. Fifty forested plots were monitored within four study areas, receiving varying degrees of

hurricane damage. Inventories included species, damage class, tree diameter, and small regeneration. The objectives of this study were 1) to compare the recovery speed of wetland forests, and 2) to discover how the degree of hurricane wind damage can affect the timing and the pattern of forest recovery in the coastal plain. Over the 24-year period following the hurricane, successional pathways have been variable among plots of different forest types and intensity of initial disturbance. We have observed an expected increase in basal area following the disturbance. Sapling populations in many species increased dramatically and some of these populations have begun to thin in recent years. In several forest types, *Pinus taeda* (not a predominant species at these sites prior to the hurricane) responded quickly and overtook some dominant species in basal area and tree/sapling abundance. Several other species that were not a major component of the tree strata (*Morella cerifera*, *Fraxinus pennsylvanica,* and the invasive *Triadica sebifera*) showed a large increase in sapling population, taking advantage of the increase in site resources before declining in density due to self-thinning. Overall, recovery speed and species resilience was specific to forest types and study sites. The intensity and frequency of hurricanes may increase in the future as sea surface temperatures rise. Understanding how coastal forests respond to major hurricanes in the long-term and short-term will aid us in preparing for future hurricanes and for potential changes in disturbance regimes.

1914 - Variables affecting community composition of fish gastrointestinal microbial flora

Daniel Delgado, Peter Sakaris, Sharon Keller, Wendy Dustman, Alexandra Lee Kutz, Rebekah Ward

Georgia Gwinnett College, Lawrenceville, GA

The degradation of water quality due to pollution can have adverse effects in many fish species important for creek and stream ecosystems. As pollution affects the water quality, the microbiota of fish gastrointestinal tract may also changed which could potentially alter host digestive capacity and diet. A study of the gastrointestinal microbiota of two local fish species was conducted across three streams, each stream containing differing levels of pollution. Research focused on sunfish and catfish microbiome in three different tributaries of the Chattahoochee River across two distinct seasons (Fall and Spring). Presence of narG (nitrogen fixing gene), dsrA (sulfur reductase gene), bglC (cellulase enzymes), and mecA (methanogenesis gene) were also assesed. A Principal Component Analysis (PCA) was done using data obtained from each fish and sample site. Additionally, next generation sequencing of the gut microbiome phylogeny was conducted and Principal Coordinate Analysis (PCoA) was done to evaluate the effect of different variables on microbiome community structure. Finding suggest the microbiome is affected by water quality, fish species, and changes in season.

1915 - A user-guide for implementing a student-centered introductory biology course

Tracy Deem

Bridgewater College, Bridgewater, VA

Since Vision and Change was published in 2009 challenging biology educators to adopt a student-centered approach in the classroom, there have been numerous publications in support of why this pedagogical approach enhances student learning outcomes. In addition, there have been numerous strategies developed for incorporating student-centered learning in the classroom, such as case-based learning, team-based learning, problem-based learning, etc. However, there are not very many user-guides on what the day-to-day classroom looks like. Therefore, the goal of this talk is to provide an outline of how I have structured my introductory biology class with examples of class assignments and assessments.

1917 - Relationships between water quality and macrophyte communities associated with the 2015 Florida Bay seagrass die-off

Jennifer Fredley, Michael Durako

University of North Carolina Wilmington, Wilmington, NC

In 2015, for the second time in the past 30 years, a large-scale seagrass die-off occurred in Florida Bay, FL, USA. *Thalassia testudinum*, the dominant seagrass and main physical structure in Florida Bay, was most affected by this die-off; 88 km^2 of *T. testudinum*-dominated beds were completely lost. Die-off was largely isolated to a region of basins within the western bay. Multivariate analyses using water quality and macrophyte community data from 13 permanent transect sites over the period 2013-2016 were used to compare environmental and biological relationships between basins that underwent die-off and those that did not. Basins that underwent die-off tended to have greater pH, salinity, sediment depth, TPO_4, and TOC, and lower NO_x and water depth. Basins that underwent die-off also had significantly different macrophyte communities from those that did not undergo die-off. Specifically, there was lower macroalgae abundance and about five times as much *T. testudinum* cover. When basins were defined by their macrophyte communities and separated based on associated water quality parameters using LINKTREE analysis, all basins that underwent die-off had an average salinity greater than 35.9 and average TPO_4 greater than 6.08 µg/L over the study period. These results, along with previous literature, suggest that basins with high TPO_4, deep sediments, and shallow waters support dense beds of *T. testudinum*, which may increase susceptibility to die-off when combined with periods of extremely high salinity and temperature. Management efforts to increase freshwater input to Florida Bay may help prevent future die-off events in two ways: salinity will be decreased, and the resulting estuarine environment may favor mixed-species seagrass beds with higher algal abundances and lower abundances of *T. testudinum*.

1919 - Can wildfire accelerate mesophication following long periods of fire exclusion in Appalachian forests?

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In fall 2016, the Southern Appalachian forests experienced the largest outbreak of wildfires in over a century. These fires occurred after more than a century of a near absence of fire and after major changes in forest composition. Consequences of the lack of fire has been both an increase in the abundance of mesic species (mesophication) and the development of a deep organic soil horizon or duff layer in areas dominated by fire dependent tree species such as oaks and hickories. Duff represents a novel fuel in frequently burned ecosystems and duff consumption in fire is linked to high delayed tree mortality. In the Southern Appalachians we are testing the hypothesis that wildfires occurring after long periods of fire exclusion will result in high post-fire mortality and accelerate mesophication. We propose that litter characteristics and mycorrhizal symbionts representative of mesic versus fire dependent species can create a positive feedback favoring mesic species. Oak litter while conducive to carrying fire, is also resistant to decomposition and oaks are associated with ectomycorrhizal symbionts that are less efficient decomposers. Therefore, an O horizon (duff layer) is more likely to form in areas dominated by oaks. Should a wildfire occur after decades of fire exclusion, high post-fire mortality is expected due to the consumption of duff and the subsequent root damage. Alternatively, in areas dominated by mesic species, their more labile litter and arbuscular mycorhizzae symbionts result in little duff formation and less post fire mortality. We are testing this hypothesis within the perimeter of the Rock Mountain and Rough Ridge fires that occurred the Chattahoochee-Oconee and Nantahala National Forests. We report initial findings on patterns of duff formation, consumption and initial mortality estimates.

1922 - The Effects of Exotic Invasive Plant Species on Pollinator Biodiversity in a Deciduous Temperate Forest

Kylie Lawrence, Darlene Panvini

Belmont University, Nashville, TN

Lonicera maackii (bush honeysuckle) and *Ligustrum sinense* (Chinese Privet) are two common exotic invasive plant species in Middle Tennessee forests. These exotics can negatively impact bee and pollinator diversity and abundance in forests while also negatively affecting the forest as a whole by outcompeting native plants. This study looked at the effects of exotic plants on bee and pollinator diversity in an urban deciduous forest in Nashville, TN. Nine plots with five collection traps each were established in areas varying from high exotic plant density to low/no exotics. Insects caught in the traps were collected within 72 hours and identified to genus. The results show that more pollinators are found in areas with an intermediate density of exotics and fewer pollinators in areas of dense exotic plants. The long-term implications are that exotic plants can impact natural areas by changing pollinator diversity which in turn can affect plant diversity.

1923 - Patterns of plastome degradation in the Buchnereae clade of Orobanchaceae

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Multiple losses of photosynthesis have been reported in Orobanchaceae, a large family of parasitic plants: in the *Orobancheae* lineage, in *Lathraea* (toothwort), and within the tribe Buchnereae. Several members of this clade demonstrate hallmarks of holoparasitism: reduction of structures and functions associated with photosynthesis and nutrient acquisition, including leaves reduced to scales, a lack of chlorophyll, and the absence of roots. With the evolution of holoparasitism, lack of functional constraints is thought to result in degradation of the plastome. Previous studies have shown that *Harveya* retains a functional copy of the photosynthetic gene *rbcL* with evidence of purifying selection, despite being by all appearances incapable of photosynthesis. Conversely, *Buchnera floridana* bears none of the hallmarks of holoparasitism, but carries an *rbcL* pseudogene. In this study, plastomes of putative holoparasites in *Aeginetia, Christisonia*, *Harveya,* and, *Hyobanche* are compared to closely relate, putatively photosynthetic species in *Alectra, Buchnera, Cycnium, Melasma*, *Micrargeriella, Sopubia,* and *Striga*. Results demonstrate a range of degradation within the genus *Harveya*; plastomes of *Harveya huttonii* and *H. squamosa* show little degradation (limited to pseudogene formation and loss of *ndh* loci), the *H. scarlatina* plastome also exhibits loss and pseudogenization of genes associated with photosynthesis (excluding ATP synthase genes), as well as genes encoding RNA polymerase. Gene loss and pseudogenization in *Hyobanche atropurpurea* exhibit similar patterns to *H. scarlatina*; phylogenetic analysis indicates that these changes werec onvergently derived. Plastomes of *Christisonia* and *Aeginetia* are respectively 51% and 37% the size of the plastome of hemiparasitic *Alectra capensis*. Furthermore, they exhibit pseudogenization and loss of genes important for basic expression and housekeeping functions in addition to genes associated with photosynthesis. Though *Buchnera* and *Striga* bear none of the molecular signatures of holoparasitism, they bear plastomes with significant genomic rearrangements, the first time this phenomenon is reported in this family.

1924 - Poultry Rearing Facilities: Influences on stream nutrient concentrations and fish health in Upper Savannah River Basin

Kelly Detmer, Ryan Lea Thomas, Greg Lewis, Dennis Haney

Furman University, Greenville, SC

It is well known that surrounding land usage can affect nearby streams through runoff and discharge into streams and that humans widely influence water quality and stream organisms even in rural areas. The SC Piedmont is no exception. We have observed that streams draining row crops and pasture are more incised and have lower riparian habitat quality than forest streams. However, indices of biotic integrity, fish abundance, and fish diversity do not differ significantly among agricultural and forested watersheds. A common rural feature in the Upper Savannah River Basin is the presence of poultry rearing facilities (PRFs) that can admit runoff into the watersheds. Preliminary research began in 2016 to determine if the presence of PRFs affected water chemistry and fish communities of nearby steams. The present study continued previous work by comparing 10 streams in pastured areas that did not drain PRFs with 10 pastured streams also sampled in 2016 that did drain PRFs. Water samples from each stream were collected and analyzed for nutrient chemicals. Geomorphological measurements, pH, temperature, and habitat quality were also recorded. Fish were captured at each site using a backpack electrofisher and were identified to species. The results showed PRFs were positively correlated with increased nitrate, sulfate, and ammonium concentrations in streams. Presence of PRFs was also correlated with decreases in fish abundance. In sites lacking PRFs, increased ammonium concentrations were associated with greater surrounding pasture land cover which also correlated with fish species declines. Fewer relationships were found between the factors measured in streams lacking PRFs than in the streams that drain the facilities, which could indicate that PRFs have a larger effect on the water chemistry and fish populations of the streams. It appears that increased stream nutrient levels from PRFs may have a negative effect on fish abundance in those streams.

1926 - Examining the presence of *Escherichia coli* and fecal coliforms at Percy Priest Lake in Nashville, Tennessee

Hannah Forgani, Chris Barton, Matthew Heard

Belmont University, Nashville, TN

Escherichia coli is a fecal coliform bacteria found in the intestinal tracts of endotherms. *E. coli* and other fecal coliforms are deposited into ecosystems when the intestinal lining sheds. *E. coli* presence can indicate the presence of other pathogens in the same environment. Government agencies regularly test ecosystems for the presence of these bacteria, however, they often overlook the sand that lines these ecosystems. When they test for these bacteria, they have set an abundance threshold. Recent research suggests sand could be a source of bacteria in these ecosystems so more studies need to be done to examine the differences in bacterial abundance between water and sand. In our study, we collected multiple samples at Percy Priest Lake and determined *E. coli* and fecal coliform abundance in sand and water. Our findings indicate that fecal coliform abundance is significantly higher in sand and most sand samples exceeded the abundance threshold.

1930 - The native root hemiparasite *Agalinis fasciculata* damages commercial pine plantations

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In 1969 damage to young slash pines (*Pinus elliottii*) by the native root parasite *Seymeria cassioides*, a chlorophyll containing hemiparasite of the Orobanchaceae, was reported for the first time. Damage was especially severe in young plantations where trees were stunted or even killed. This prompted a survey of native root parasites of the Southeast using pot studies

where parasites were grown with commercial tree species. Several species of *Agalinis*, false foxglove (Orobanchaceae), were included in the pot studies including *Agalinis fasciculata*, widespread in southern states, especially southern Georgia and northern Florida. All parasitized a wide range of gymnosperm and dicot hosts. Because of its broad distribution and common preference for disturbed areas, it was hypothesized in 1979 that *A. fasciculata* could become a pathogen in commercial tree plantations. In 2016 unexplained stunted growth and mortality was noted in three-year old loblolly pine (*Pinus taeda*) trees in Clinch and Ware counties in Georgia and found to be caused by *A. fasciculata*. Excavation of the trees showed haustoria on the roots confirming parasitism. Currently we are researching seed behavior and growth loss in pot studies.

1931 - Using SERNEC data to improve understanding of the distribution of sedges in the Carolinas

Bruce Sorrie

University of North Carolina-Chapel Hill, Chapel Hill, NC

Maps in Radford, Ahles, and Bell (1968) show the county distribution of 291 taxa of sedges (Cyperaceae) (taxa with only a few records are not mapped; counties are listed by name). Records came primarily from the herbarium at University of North Carolina at Chapel Hill (NCU); additions came from over a dozen more herbaria. With passage of time and databasing of specimens into the SERNEC Portal, the vast majority of taxa have gained new county vouchers relative to the RAB maps (>85%). In many instances, the increase in number of counties is substantial, i.e., *Bulbostylis barbata* in SC with 10 counties added to the 24 in RAB. Images in the SERNEC database are highly useful in verifying or refuting the identity of sedge specimens. Complete specimens of *Rhynchospora pallida* show bulbous plant bases, unlike those of *R. alba* and *R. macra*; the distichous arrangement of perigynia distinguishes *Carex planispicata* from *C. amphibola* and *C. corrugata*. However, there are some species groups of sedges which require mature achenes under a scope for sure identification (i.e., *Carex pigra* vs. *C. glaucodea*). Specimens without images are problematic, as identification cannot be assured via SERNEC. Specimen label data, especially phytogeographic province and habitat, are very useful to corroborate the identification of a specimen, but by themselves (without image) cannot be relied on.

1938 - Impacts of recent hurricanes on the upper Savannah River estuary

Jamie Duberstein, William Conner, John, Jr. Salter

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Natural tidal wetlands in the southeastern Unites States reflect their topographic gradient, watershed, local weather, and past hurricane exposure. The Savannah River estuary recently experienced multiple hurricanes, including Hurricane Matthew and Hurricane Irma. We summarize the impact to the freshwater and oligohaline tidal marshes, and tidal freshwater forests, in terms of surge level and aboveground salinity intrusion, as well as salinity entrainment into soils. Hurricane Irma impacts to National Wildlife Refuge infrastructure and associated 6000 ac waterfowl habitat will be summarized. Site-specific soil salinity values from recent decades will be compared to contemporary conditions to provide insight into potential weather impacts to the marshes within the refuge.

1942 - Systematics and phylogeography of a biologically invasive cosmopolitan freshwater snail, *Physa acuta*

Amy Wethington

Chowan University, Murfreesboro, NC

Among North American freshwater macroinvertebrates, physids are the most prominent given their abundance and dispersal capabilities (Dillon 2000). In particular, *Physa acuta*, a biologically invasive species, has been reported to have a worldwide distribution. Here we document sequence variation of two mitochondrial genes (n = ~ 20/ population; total = 132) as well as seven polymorphic allozyme loci (n ≥ 30/ population) variation in six populations representing three nominal species within the *acuta* group (*Physa acuta*, *P. heterostropha*, and *P. integra*±± 0.0195). Over half of the genetic variance observed in the mitochondrial data was explained by variation among populations within species or continents, and the rest was explained by within population variation (ranging between 2.53% and 13.3%). None of the variance was explained by nominal species or continents. The Nei genetic distances among populations of *P. acuta* from Indiana, Michigan, Pennsylvania, South Carolina, Ireland, and France, based on gene frequencies at seven allozyme-encoding loci, range from 0.022 to 0.843 which is comparable to values found in an earlier study involving ten populations of *acuta* within Charleston County, South Carolina. Neither the allozyme data nor the mitochondrial data uncovered any appreciable difference in genetic diversity between North American or European populations. These six reference populations, including one topotypic population of each nominal species, comprise one phylogenetic species using the Phylogenetic Species Concept. These data show consistency between the PSC and BSC in delimiting species boundaries in physids.

1944 - The role of species abundance in determining risk of extinction caused by habitat loss

Ryan Almeida, Kevin Smith

Davidson College, Davidson, NC

The role stochasticity plays in determining a species' local extinction risk in face of a disturbance is often neglected among conservation biologists in favor of trait-based selective extinction processes. While the importance of deterministic mechanisms as a driver of extinction is not disputed, if chance-based processes are not considered, we risk misinterpreting the potential importance of species' abundance and other correlates of extinction risk. To address the influence of stochasticity on species extinction risk, we applied a null model approach to analyze local macroinvertebrate extinctions in a series of experimental terrestrial ecosystems that were subject to experimental habitat destruction. Each mesocosm included sixteen *Solidago altissima* individuals serving as habitat for a regional total of 110 macroinvertebrate taxa. Mesocosms were surveyed for macroinvertebrate diversity prior to habitat destruction, with an additional two surveys occurring immediately and three weeks after the treatment. Observed macroinvertebrate extirpations were compared to null-expected extinctions formulated through a sample-based rarefaction null-model; under the assumptions of the null model, species loss is dictated by the random removal of individual plants from each mesocosm. As a result, observed extinctions that deviate from our null expectations may be evidence of deterministic and trait-based extinction processes. Initial results of our analysis indicate that null-expected species richness is a weak predictor of observed richness immediately after disturbance (R^2 = 0.34, p = 0.08), but is a significant predictor three weeks after disturbance (R^2 = 0.61, p = 0.007), suggesting an important role for species abundance in determining extinction risk. Interestingly, we observed significantly greater than expected losses of biodiversity at the regional level despite most observed extirpations being consistent with random chance. Ultimately, our findings suggest that species' abundance is an important factor to be considered in assessing a species' extinction risk, and the relative importance of random processes may be scale-dependent.

1946 - Broad-scale biogeographic patterns in dispersal morphology among the Southern Appalachian mixed mesophytic flora

Samantha Tessel

University of North Carolina, Chapel Hill, NC

Among the southern Appalachian mesophytic flora, differences in dispersal morphology affect local and regional frequency, geographic range size, and biogeographic affinity. Vascular plant species of mixed mesophytic communities in the Great Smoky Mountains National Park were documented in 47 1-hectare plots located across many areas of the park. Though patterns in frequency and range size vary substantially within dispersal categories, species without adaptations to dispersal by wind or vertebrates are less frequent across the landscape and generally have more restricted geographic range sizes. The distribution of higher-level taxonomic groups is also related to dispersal morphology, where species dispersed by endozoochory are overrepresented among taxa with Tertiary-disjunct affinities, and species without obvious dispersal adaptations are more likely to be from lineages endemic to North America. Trends in other morphological traits include a high frequency of umbrella-shaped herbs among Tertiary disjunct lineages, and a high frequency of ternately compound and serrate leaves among the southern Appalachian endemics in mesophytic communities.

1947 - Parasite Communities of Cormorants and Scaup roosting near aquaculture ponds in the southeastern US

Kate Sheehan

Southern Arkansas University, Magnolia, AR

One major issue concerning modern society is the assurance of sustainable food sources. Modern aquaculture attempts to meet that need; however, obstacles such as food conversion rates and disease can reduce their yield. Parasites transmitted from wildlife to farmed animals can be problematic and it is important that the sources of infection are identified so that corrective actions can be developed and implemented. Here, I document the parasites occurring commonly in two waterbirds that frequent aquaculture ponds in the southeastern US: Double-crested Cormorants (*Phalacrocorax auritus*) and Lesser Scaup (*Aythya affinis*). I will compare parasite intensities and community structure in birds from different seasons, sharing anecdotes of migration patterns and parasite life cycles to shed light on the patterns of infection and how they might influence the health of farmed prey species and the businesses that rely on them. Finally, I will discuss current practices for depredation activities and their effectiveness at promoting high efficiencies within aquaculture.

1948 - Lycorine hydrochlorine induces a proliferative arrest in colorectal cancer cells.

McKenzie Roberts, Chris Barton

Belmont University, Nashville, TN

Alkaloids are nitrogenous compounds extracted from plants and animals that have demonstrated the ability to inhibit the growth of cancer cells. One type of alkaloid, lycorine hydrochloride, has halted growth in multiple cancer types and has acted synergistically with other compounds, but its effects on colorectal cancer are unknown. We investigate whether lycorine hydrochloride presents antiproliferative effects on colorectal cancer. We show that lycorine hydrochloride promotes cell cycle arrest in colorectal cancer cells in culture. Alternatively, we show that lycorine hydrochloride does not have synergistic effects with the commonly used chemotherapeutics, 5-FU and etoposide. Our data indicates that lycorine hydrochloride could be utilized as a possible compound in treating colorectal cancer and produce better effects when used without other chemotherapeutics.

1952 - Specimen digitization and crowdsourcing as a driver of productivity in undergraduate-dominated laboratories.

Emily Gillespie

Marshall University, Huntington, WV

Mobilization of natural history data began in earnest during the mid-2000s, facilitating a new research 'layer': the incorporation of large amounts of data collected by researchers other than oneself as a way to enhance studies in plant evolution. Data including geocoordinates, phenology, life history data, and data related to broader trends such as distributional changes are obvious benefits of the growing number of specimen portals and other crowd-sourced resources, however other intangible benefits are beginning to emerge. Here, examples of undergraduate projects that have been markedly improved by incorporating crowd-sourced resources are described, as well as specific 'best practice' suggestions for maximizing the utility of these resources in a sustainable way.

1953 - The Effect of PH on a Freshwater snail's (*Elimia laqueta) ability to detect predator and alarm cues.*

Dylan Adler, John Niedzwiecki

Belmont University, Nashville, TN

Detecting chemical cues known as kariomones is vital for anti-predator responses in snails. Many aquatic snails have been shown to exhibit crawl out behavior in response to kariomones. Acidification of freshwater systems, may occur through a variety of mechanisms, potentially including increased levels of carbon dioxide in the atmosphere. Previous studies showed acidity may effect the ability of aquatic organisms to detect chemical cues. In this study we hypothesized that, acidity may inhibit the snail, Elimia laqueta's, ability to detect and respond to predation cues. Snails were collected and put into two separate pH conditions, normal and slightly acidic, and in either control water or water with alarm cues and crayfish predator cues. Snail locations and activity were recorded. Results show that the typical anti-predator response, in the form of crawl out behavior, was so great in acidic tanks that it was impossible distinguish if snails' ability to detect cues was inhibited by acidic conditions. Snails in all acid treatments and snails with predator cues showed increased crawl out behavior relative to control snails. Snails in acidic conditions began to return to the water late in the experiment, so in future studies, it may be useful to first habituate snails to acidic conditions before introducing cues. However, it can be concluded that snails do have an averse reaction to mildly acidic water and to predator-associated kariomones and the effects of the interaction of these conditions should be studied further.

1958 - Amodiaquine, an anti-malarial compound, inhibits the growth of epithelial cancer cells in culture

Bailey Bergmann, Chris Barton

Belmont University, Nashville, TN

Cancer is currently the second most common cause of death in America, so it is vital that research continue in order to effectively treat those affected by this disease. Amodiaquine is a drug with anti-inflammatory properties that is typically used to treat patients with malaria, but it has also been shown to kill human melanoma cells grown in culture. Whether amodiaquine is effective in other cancer types is currently unknown. To explore this, we used colorectal and lung cancer cells as a model to test whether amodiaquine is effective as an antiproliferative drug. Our data show that amodiaquine exposure results in a significant decrease in mitosis and a significant increase in apoptosis in all studied cancer cell types. Further analyses are needed to identify genes that are important for cellular response to amodiaquine.

1963 - New Primers for Determination of Pathogenic Fusarium Species

Alexandra Agee[1], Michelle M. Barthet[2]

[1]Coastal Carolina, Conway, SC, [2]Coastal Carolina University, Conway, SC

A phylogenetic study was conducted on the ubiquitous saprotroph fungal genus Fusarium. Many members of this fungal genus are known primarily as plant pathogens, however, are also known to become zoonotic in nature allowing the pathogen to be transferred from plants to animals. Members of the Fusarium solani Species Complex (FSSC) as well as F. falciforme and F. keratoplasticum, two former members of the FSSC, have been implicated as causative agents in human mycoses. Further, these same Fusarium species have been implicated as a contributing factor to the abnormal death of endangered sea turtles. Identification of individual species of Fusarium or members of the FSSC is often difficult and requires an expert mycologist. This study has utilized the abundance of sequence data for the ribosomal polymerase subunit 2 gene (RPB2) from GenBank for phylogenic analysis and developed secondary DNA barcoding primers for members of the FSSC as well as species-specific primers for F. keratoplasticum and F. falciforme for use in clinical and ecological settings.

1967 - Weather and climate linkages that set the stage for the 2016 Southern Appalachian fire season

Marcus Williams, Scott Goodrick, Joseph O'Brien

USDA Forest Service, Athens, GA

During the late fall of 2016, an ongoing drought created a favorable environment for fire ignitions in the southeastern United States. Many of these ignitions occurred in the Southern Appalachian Mountains. The result, with one exception, was a series of low intensity, high severity wildfires. The exception was a high intensity event that initially started in the Chimney Tops area of the Great Smokey National Park. The Chimney Tops 2 fire eventually burned into the Gatlinburg, TN area and caused 14 fatalities, burned approximately 2,500 structures, and caused $2 billion in damages. The focus of this presentation will not be on the fires themselves, but on the possible climate and weather conditions that created the environment for the unusual fire season. There are many known linkages between climate and fire behavior, with drought and fire behavior being a well-established example. The severity of the 2016 drought is analyzed and placed into historical context through comparison to prior droughts in the region. The presence of well-known seasonal climate variability – fire relationships, such as the El Nino – Southern Oscillation (ENSO) will be analyzed to characterize how the relationship contributed to the 2016 fire season in the Southern Appalachians. The previously mentioned Chimney Tops 2 fire is highlighted as it was the result of extremely high wind during the time that the fire made its greatest run from around 50 acres to over 17,000 acres. The extraordinary run was the result of the fire interacting with an approaching frontal system. The meteorological phenomena responsible for the Chimney Tops 2 fire spread is analyzed and discussed.

1970 - The effects of deterministic and stochastic processes on hardbottom community assembly through time and space

Zachary Long, Wilson Freshwater

UNCW, Wilmington, NC

Community assembly can affect species coexistence through mechanisms that range from stochastic processes (e.g., demographic variability, dispersal) through deterministic interactions. In this study, we investigated how offshore benthic hardbottom communities varied among five different sites along a depth gradient (15-40m) and through time (2 years) in Onslow Bay, North Carolina, to determine how stochastic and deterministic processes affected the seasonal development of the community. We found that all five sites converged on a similar composition in winter and diverged during the growing season. Community composition was determined primarily by deterministic interactions. Our results suggest that there are constraints on community membership within this area especially caused by depth and distance from shore / proximity to the Gulf Stream and composition is not random. The

differences between the community composition of the sites we observed may be maintained by limited dispersal among the hardbottom habitat islands.

1980 - Stable inheritance of olfactory imprinting in *Caenorhabditis elegans*

Hope Kramer, Robert Grammer

Belmont University, Nashville, TN

This study sought to verify *Caenorhabditis elegans* olfactory imprinting and its ability to pass transgenerationally. *C. elegans* have been recognized to imprint on certain olfactory stimulants when exposed in the L1 life phase. This imprinting results in an increased chemotaxis towards the stimulants as adults. Here, isoamyl alcohol, IAA, was used as the olfactory stimulant, imprinting on L1 N2 worms. Naïve worms were used to determine base-line attraction to isoamyl alcohol in a variety of dilutions. Bleach synchronized worms were used for age consistency. Up to 6 continuous generations were imprinted and tested for increased chemotaxis response to two dilution levels, one at the top of the dose response curve and one further down, 1/200 and 1/2000 respectively. Each imprinted generation had up to 5 subsequent generations of non-imprinted progeny tested to determine if these changes which induce imprinting can pass on transgenerationally and if they could be stably inherited. We obtained inconsistent imprinting results for the primary exposed generations but did find some indication of imprinting responses in later un-exposed generations. However, no continuous, stable, inheritance response was found.

1981 - Investigating the use of quorum sensing molecules in the pathogenic pathway of *Bacillus thuringiensis* in *Caenorhabditis elegans*

Brooke Pugsley, Robert Grammer

Belmont University, Nashville, TN

Bacillus thuringiensis (Bt) is a spore-forming bacterium that is pathogenic to *C. elegans*. The route of its pathogenicity is not completely known in nematodes, but previous studies have shown quorum sensing (QS), the idea that bacteria communicate through pheromones to gain information about the environment and other cells, plays an essential role in Bt's infection of insects after sporulation. More research is needed to fully understand the importance of QS. A growth curve has been created for Bt in enhanced liquid medium, indicating growth begins to flatten off past 20 hours but does not stop completely. Additionally, it has been observed that sporulation of Bt takes longer in enhanced L broth than on an LB agar plate. In the future, this study will use media containing QS molecules from sporulated Bt to surround vegetative Bt, revealing if the bacteria can quorum sense in that stage of life.

1982 - A new application to avert transcription errors in digitization of Natural History collections: Stopping the "taxonomic telephone."

Caleb Powell, Jacob Motley, Hong Qin, Joey Shaw

University of Tennessee at Chattanooga, Chattanooga, TN

In the last ten years, workflows for digitizing Natural History collections have been designed to retroactively modernize legacy data. However, as a community we are still employing classic field collection techniques, and as such the field-to-data-portal workflow requires herbarium records be transcribed at least twice before digitization. This is similar to a schoolyard game of "telephone," i.e., in accumulating serial transcription errors in biocollections data. A modernized field collection method can avert errors, costs, and delays associated with transcriptions, allowing new records to be born digital. Here we present the development of one such method: an Android field application capable of generating many of the requisite fieldnotes (e.g., state, county, GPS coordinates, date) and a desktop companion, within which

additional data might be added (e.g., identification notes) and labels might be generated. The resulting data are ready for uploading to online portals, like the Southeast Regional Network of Expertise and Collections (SERNEC).

1984 - Movin' on Up: Mycorrhizal Mutualisms and Assisted Migration of Coastal Plant Species

Bradley Delfeld[1], Loretta Battaglia[1], Pamela Weisenhorn[2], Benjamin Morgan[3], Louise Egerton-Warburton[4]

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Coastal marshes are among the first ecosystems to be altered by climate change. With increasing sea level rise, assisted migration may be necessary to establish founder populations in more favorable upslope habitats. Mycorrhizal mutualisms could play a key role in determining success of these moving populations. The objectives of this study are: (1) to identify potential mycorrhizal relationships by determining whether assemblages of spores exhibit zonation mirroring that of coastal plant communities and (2) to test whether abundance and composition of mycorrhizae in roots of a dominant marsh species (*Juncus roemerianus*) differ with simulated assisted migration into upslope soils. Soil samples and seeds for trap plants were collected from the coastal coenocline at Grand Bay National Estuarine Research Reserve in coastal Mississippi. A total of 1694 unique operational taxonomic units (OTUs) was found across the entire gradient. The soil samples had an average of 196.25 OTUs per sample while the root samples were less diverse with an average of 29.04 OTUs per sample. The DNA analysis of the soil samples show that the Glomeromycete spores exhibit little to no zonation on the seaward end of the gradient (salt and brackish marsh), but moving upslope to the fresh marsh and pine woodlands, the spore composition becomes increasingly zoned. Species richness and abundance in the soil samples increased along the elevation gradient; they were highest in the pine woodlands and lowest in the salt marsh. The salt marsh showed isolation in its species composition sharing only two OTUs with the other three zones. The brackish marsh, fresh marsh and pine woodlands exhibited species overlap among most of the dominant OTUs. These results indicate that apart from the salt marsh, these plant-mycorrhizae relationships can persist after upslope migration of coastal plant species.

2098 - Status of Rare and At-Risk Plant Species of South Carolina Lowcountry National Wildlife Refuges

Keith Bradley

University of South Carolina, West Columbia, SC

Six National Wildlife Refuges in the coastal plain of South Carolina have habitats that are suitable for at least 11 petitioned rare plant species ("At-Risk"), as well as populations of Federally-listed and other regionally rare plant species. These refuges were surveyed in 2016 and 2017. Rare plant populations were mapped, habitats characterized, and threats identified. Survey results show that these National Wildlife Refuges have significant populations of previously undetected rare plants species. Several of these are Federal At-Risk species, including Coreopsis integrifolia, Isoetes hyemalis, Macbridea caroliniana, Nuphar sagittifolia, and Ptilimnium ahlesii, were found at one or more refuges. Incidentally, new exotic plant species for South Carolina and Georgia have also been discovered during these surveys. These data are used to make recommendations for long-term habitat management.

2126 - Going, going, gone: coastal floodplain forest disassembly and dynamics in the Louisiana Deltaic Plain

Loretta Battaglia[1], Julie Denslow[2]

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Hydroperiod and light availability are the two main drivers of bottomland hardwood forest dynamics in the southeastern US. In coastal landscapes such as the Louisiana Deltaic Plain, saline intrusions from storm surge and sea level rise are additional stressors that shape these floodplain forests. We hypothesized a two-step process whereby forest communities in this system undergo disassembly consistent with rapid relative sea level rise, followed by compositional shifts indicative of upslope migration. In 1998, a permanent five-hectare monitoring plot was established at the Barataria Preserve Unit in Jean Lafitte National Historical Park and Preserve, Jefferson Parish, Louisiana. The plot paralleled the elevation gradient from the natural levee of Bayou des Familles to its semi-permanently flooded backswamp. All woody stems ≥ 2.5 cm DBH were tagged, identified to species, measured, and mapped using a Topcon Total Station. The plot has been resurveyed six times since its establishment to track temporal patterns of recruitment, mortality, growth and composition. The results unequivocally show that the forest is disassembling due to high mortality and exceedingly low recruitment limited mostly to vegetative reproduction. Apart from *Taxodium distichum*, the most flood-tolerant species in the community, other dominant species had population declines throughout the study period. Despite these openings in the forest, only two species showed evidence of limited upslope migration. Although minimal, establishment of freshwater marsh species was observed in recent years, suggesting that a state change to marsh may have begun in the backswamp. Multivariate community analyses revealed no statistically significant changes but rather subtle shifts in composition due to varying levels of dwindling abundances. In high speed landscapes, the rate of environmental change affects the pattern and rate of disassembly, which in turn can delay or hasten reassembly and state changes.

2129 - Investigation into the Status of Non-native Plant Species in Tennessee Using the SERNEC Herbarium Database

Courtney Alley

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Almost 17% (486) of the plant species in Tennessee are non-native to the state. These species are a substantial threat to the native flora and native ecosystems in Tennessee and as such they are a problem for conservation. Detection, and ultimately monitoring, of these species presents tremendous challenges to conservation groups. As a first line of defense, organizations such as the Tennessee Invasive Plant Council (TN-IPC), work to list and rank non-native species. Up until recently, organizations such as these have relied heavily on expert opinion and experience to rank non-native species. However, with the onset of metadata technology, the ability to access large amounts of information has transformed the ways in which we might enhance our understanding of the threat of non-native species across the landscape. To assess the status of non-native plants in Tennessee, this study is focused on specimen-supported data and we have pulled such data from the South East Regional Network of Expertise and Collection (SERNEC) database. In January, 2018, we searched the SERNEC database for all records of the 486 non-native species of Tennessee that were collected within the political boundary of Tennessee. This search revealed 24,408 herbarium specimens. Analysis of these specimens shows over 50% of all non-native species are ported in 5 or more geographical regions, and that significant spread has occurred in several species including, Cardamine hirsuta which is represented in 81% of Tennessee counties. This study demonstrates the extent to which this recent development in metadata based tools can be utilized to investigate the status of non-native plants and lead to the development of more efficient monitoring techniques of non-native species.

2130 - Improving the breadth of scientific communication skills through video

Jeffrey Thomas, Patricia Koplas

Queens University of Charlotte, Charlotte, NC

As emphasized in the AAAS Vision & Change 2011 report, scientific communication is a fundamental skill to students in biology. They emphasize the value of both formal and informal methods of communicating science to diverse communities. At Queens University of Charlotte, we have built on this core competency by emphasizing audience-specific scientific communication as a learning outcome for our biology majors. In focusing on this skill, we recognized that student presentations are often set up to mirror conference presentations in time and structure and so their audience is limited to faculty and peer experts in their areas. In order to foster the development of more informal science communication and to help students build the skills to communicate science to multiple audiences, we needed to create opportunities in the curriculum for students to present and discuss science with people outside of their major. In several upper division biology courses, we have created video assignments that require students to present scientific content to non-technical audiences in an engaging way with the goal of improving their own understanding of these concepts. Here we present the structure of student assignments in animal behavior and cell biology courses, as well as examples and student reactions to the work.

2134 - Leaf and stem photosynthesis and phenology as determinants of the ability of *Rosa multiflora* to invade and persist in Southern Appalachian forest understories

Ivy Culver, Emily Riffe, Howard Neufeld

Appalachian State University, Boone, NC

Rosa multiflora (multiflora rose), an invasive, perennial shrub, was brought to the United States from East Asia in the early 1800s for ornamental, and later, for agricultural use. An invasive, multiflora rose is noted for its reproductive success, with one plant capable of producing one-half million seeds annually. Although known for its preference for open and edge habitats, it has recently invaded forest understories in the Southern Appalachians, raising the question of how it persists under such shady conditions. Some *Rosa* sp. succeed in the understory by utilizing sunflecks provided by gaps in the canopy, but multiflora rose may also have wide tolerance to varying light intensities. Multiflora rose also has green stems year-round, suggesting they may contribute to CO_2 assimilation in the "off" season when the plant and canopy are leafless, and this could contribute to its later success in the understory. We took weekly phenological measurements on plants growing beneath the canopy in the ASU Nature Preserve, and showed that multiflora rose started leafing-out by mid-February, some ~4-6 weeks before native vegetation and kept its leaves until early December, nearly 6 weeks longer than native species. Diurnal gas exchange data of leaves, obtained at approximately monthly intervals, show high daily carbon gain prior to canopy leafout in spring (89.6 mmol CO_2 m^{-2} day^{-1}), much lower values in summer when the canopy is fully leafed out (10.5 mmol CO_2 m^{-2} day^{-1}), and a slight increase again in the fall as the overstory canopy senesces (54.6 mmol CO_2 m^{-2} day^{-1}). During the winter, we plan to make measurements of stem photosynthesis to determine the contribution of this mode of carbon gain to its survival in understory environments. An extended phenology, possibly coupled with the CO_2 assimilation by stems contribute to the success of multiflora rose in the forest understory.

2139 - A Quantitative Analysis of a Kale Hybrid, *Tronchuda beira* Grown on an Extensive Green Roof, Garden and EarthBox

Caroline Glover, Darlene Panvini

Belmont University, Nashville, TN

Urban agriculture is becoming more difficult to accommodate due to the lack of green space in urban areas. Extensive green roofs are known for successful carbon sequestration and the plants grown there are often heat and drought-tolerant. Few studies have examined vegetable growth on green roofs, especially in comparison to vegetables grown in more traditional garden plots. In this study, a green roof, a community garden, and EarthBoxes were used to

compare growth of a kale hybrid, *Tronchuda beira,* in different environments. Dry mass, height, level of herbivory, soil texture, soil nutrient analysis, solar irradiance, and soil and air temperature were determined to note differences in the growth of plants in the growing environments. Significant differences in growth were observed between the different sites, with the Earthboxes demonstrating more growth. However, growth in the Earthboxes was comparable, regardless of location. Differences in levels of herbivory, air and soil temperatures, and solar irradiance were observed between sites. The overall significance of the study is to examine the possibility of using green roofs to expand urban agriculture.

2150 - Exploring forest fire effects on biodiversity through a novel use of sound

Samuel Crummett, John Quinn

Furman University, Greenville, SC

Disturbances, such as wildfires, can have changing, and even regenerative effects on the plant and animal diversity of a system. While these changes have been heavily documented, what is less clear is how sound, through animal vocalizations, is affected by disturbance. The effects of the recent forest fires on the ecology of Western NC and Upstate SC were examined through sound by comparing burnt and unburnt sites, and how they vary over a 24 hour period. We gathered data through automated recording units over a 2 week period at 3 burned and 3 unburned sites. Indicators of sound, reflecting biodiversity, varied greater during specific times of day than others across burnt and unburnt sites. For instance, biophony values at unburnt sites varied greater during the hours of sunrise and sunset than those at burnt sites. There was also a much larger range of Acoustic Evenness Index (AEI) and Acoustic Diversity Index (ADI) values at burnt sites than unburnt sites. The data shows that forest fire disturbances cause large changes in wildlife sounds, either by increasing or decreasing the range of certain values. Though the values are varying, what is clear is that biodiversity is affected by forest fires, and we can determine this through sound, and even parse the effects out across the times of day. This understanding of sound can be used to more efficiently gather data on biodiversity, and also to see the effects of forest fires on a larger scale.

2153 - Mercury liver residues in Raptors collected in the Carolinas

Scott Weir, Jeffrey Thomas

Queens University of Charlotte, Charlotte, NC

Raptor population dynamics in the eastern US are variable with some species declining while others are stable or growing. For species that are in decline, it is important to investigate multiple possible causes of declines which could include environmental contaminants. Mercury is a toxicant that is known to cause toxic effects in wildlife that are regularly exposed, but it is often not known how much exposure is occurring in some species that are not routinely collected. We investigated mercury concentrations in liver samples taken from various species that were admitted to the Carolina Raptor Center and were later euthanized. We analyzed 39 liver samples from 13 species for total mercury concentrations. As expected, birds associated with piscivorous diets had the highest mean Hg concentrations. Two raptor species that appear to be conspicuous in their Hg burdens were the single Eastern screech owl that was sampled (12.01 mg/kg) and the average of seven red-shouldered hawks (mean ± SD = 2.28 ± 0.79 mg/kg). The rest of the raptor species had average Hg burdens that ranged from 0.1 to 1.2 mg/kg. Species was a significant factor in our ANOVA model ($F_{8,25} = 18.04$, $p < 0.0001$). Post hoc results suggested that OSPR and GBHE had significantly higher residues than several species of raptor (BDOW, COHA, GHOW, RTHA, all $p < 0.014$). OSPR also had higher body residues than the RSHA ($p = 0.008$). Our data suggest that mercury residues in most raptor species are relatively low and likely not be a significant concern for populations, though our samples sizes for any given species are admittedly small. Importantly, two raptor species

had relatively high levels that were close to or exceeded levels of concern for birds that have been previously reported.

2159 - Regional distribution of metals in the cuticle of cicada ovipositors

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Natural selection has favored the deposition of metal ions in cuticular structures that are prone to wear or abrasion, which represents a compelling example of convergent evolution among distantly-related arthropods. Metal ions have been found in termite mandibles, spider fangs, and the ovipositors of parasitic wasps that penetrate wood for oviposition. Here, we report the presence and regional distribution of metal ions within cicada ovipositors, which is the first report of metals in the cuticle of Hemiptera (approximately 80,000 species). We tested for the presence of metals in the ovipositors of four species of cicadas, representing two genera, using a combination of scanning electron microscopy and energy dispersive x-ray spectroscopy. We found that all species have metals in their ovipositors, but the diversity and quantity of metals differs among species, which might relate to oviposition habits. In addition, the metals are concentrated at the distal region of the ovipositor where there are structural modifications for penetrating through wood for oviposition; therefore, cicada ovipositors have a structurally and chemically-defined rasping region.

2164 - Population biology of introduced barnacles, *Megabalanus coccopoma* and an unidentified species of *Megabalanus*, in the southeastern U.S.

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Introduced species often generate ecological and economic costs. Factors such as incorrect identification and sparse life history information can make assessing and managing non-native species difficult. The large barnacle, *Megabalanus coccopoma*, has established introduced populations in tropical and subtropical regions globally. Within the last decade, *M. coccopoma*, has become common in the southeastern USA where artificial structures offshore maintain dense permanent populations of large individuals. In contrast, coastal populations are less dense and suffer some level of winter decline followed by summer range expansion. Offshore populations are presumed to be the source of the summer coastal larval recruits. A second introduced species of *Megabalanus* has recently been discovered in the southeastern USA that can only reliably be distinguished from *M. coccopoma* using DNA sequence data. To date we have been unable to identify this barnacle to species level due to unknown origin, morphological variation, and inconsistent taxonomic keys. This study estimated relative abundance of the two introduced *Megabalanus* species at temporal and spatial scales in Georgia and South Carolina. In addition, we assessed the reproductive potential of *M. coccopoma* individuals in coastal populations. The unidentified species made up 30% of specimens collected at offshore sites and 0% of specimens at coastal sites. This indicates that *M. coccopoma* is more tolerant of the variable coastal conditions than the unidentified species. *M. coccopoma* sampled from coastal populations during the fall were brooding larvae. Several isolated individuals (greater than seven body lengths from the nearest potential mate) were also found to possess larval broods. These individuals must be fertilized by alternative strategies to sexual reproduction by internal fertilization common in barnacles. Self-fertilization and sperm-casting are potential fertilization mechanisms that would prove beneficial in establishing introduced populations.

2165 - Fertilization of green sea urchin, *Lytechinus variegatus,* negatively impacted by increasing temperature and acidity

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Climate change is causing environmental impacts like ocean warming and ocean acidification. Previous studies have determined that these environmental changes can affect marine life. However, there is insufficient data to explain how these environmental changes affect the green sea urchin, *Lytechinus variegatus*. Due to its geographical location in the Gulf of Mexico, *L. variegatus* could be impacted to a greater degree by climate change. This experiment examined the effects of climate change-related factors on the fertilization success of *L. variegatus*. Experimental trials (23°C, 25°C, and pH 8.1, pH 8.3) were conducted in all combinations and compared to the control (21°C and pH 8.5). Percent fertilization decreased with increasing temperature and increasing acidity. This research provides additional information towards the goal of protecting marine life from the effects of climate change with a focus on fertilization success.

2170 - Updates about the current status and conservation of Jamaica's giant swallowtail (*Papilio homerus*)

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The Homerus swallowtail, *Papilio* (*Pterourus*) *homerus* Fabricius, is the largest butterfly in the Western Hemisphere and is listed as an endangered species. *Papilio homerus* is endemic to Jamaica, where it once inhabited seven of Jamaica's 14 parishes; however, only two stronghold populations remain, a western population in the rugged Cockpit Country and an eastern population in the Blue and John Crow Mountains. Despite numerous studies of its life history, much about the population biology, including estimates of total numbers of individuals in each population and genetic diversity, remains unknown. Here, we provide a review of the biology of *P. homerus*, current threats to the remaining populations, and recommendations for a conservation plan, including the necessity for breeding programs for the continued survival of the species.

2175 - An outline of approaches that can be used for determining which moth species are pollinators

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Pollination is an important driver of many ecological systems; however, most pollination studies examine diurnal species, such as butterflies and bees. Studies of nocturnal pollinators, such as moths, are lagging, which is likely due to the inherent difficulty in studying nocturnal species. Here, we provide a review of some general approaches for assessing which moth species might pollinate. In particular, we have outlined seven approaches for studying moth pollination, including 1) searching the internet and online databases, 2) swabbing for pollen, 3) examining all moths captured in ecosystems, 4) monitoring flowers for moth visitation, 5) survey moths attracted to baits, 6) survey species using phylogeny, and 7) studying proboscis morphology. We discuss the pros and cons for each approach and provide data from our own studies of moth pollination.

2179 - Flower feeding by butterflies: The adaptive value of having a smooth proboscis

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Adult butterflies and moths (Lepidoptera) have mouthparts (proboscises) that are modified for fluid feeding. There is a relationship between the structural architecture of proboscises and feeding habits. Non-flower visiting Lepidoptera, such as sap feeders, have enlarged chemosensilla (sensilla styloconica) at the distal region that creates a brush-like tip, which has adaptive value by increasing capillary potential when acquiring fluids from porous surfaces. In addition, sensilla styloconica are hydrophilic, therefore, the presence of these structures influences proboscis wettability. Flower-visiting butterflies, however, have proboscises that lack sensilla styloconica and have a smooth-tipped proboscis, which putatively facilitates feeding on nectar within narrow floral tubes, but this has remained untested. In this study, we provide experimental evidence that supports that having a smooth proboscis enables feeding on fluids within narrow tubes. We used corolla-mimicking capillary tubes and cameras to video record proboscis-tube interactions during butterfly feeding. We found that butterflies that have smooth proboscises were able to quickly insert and withdraw the proboscis from the tubes while feeding, whereas those that have a brush-tipped proboscis routinely got stuck. Our preliminary results indicate that proboscis-tube interactions are mediated not only by proboscis architecture, but also by overall wettability.

2180 - Developing and Testing Expedient SERNEC Data Entry Solutions: a proposed modification to the SERNEC/Symbiota portal to speed data entry from images.

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In Tennessee, and as part of the Southest Regional Network of Expertise and Collections (SERNEC) collaborative, students and faculty curators have spent over 1300 hours digitizing over 400,000 herbarium specimens into the SERNEC portal. Data entry methods available in the portal are limited to “skeletal records,” which are restricted to basic fields (e.g., state, county, scientific name, barcode number, and herbarium acronym). Here, we present the results of testing a proposed SERNEC module which allows comprehensive data entry to be performed directly from images, reducing the need to physically access and handle specimens. A unique aspect of the module is the novel approach to data entry which gives users the ability to focus on fields of interest. The tool also includes adaptive zoom settings as well as selected field preservation.

2181 - Herpetofauna Occurrence in Southern Atlantic Tidal Swamps

Sidney Godfrey

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Tidal swamps provide habitats for a variety of reptiles and amphibians (herpetofauna), but their community compositions in most tidal swamps are currently unknown. Tidal swamps currently face a number of threats, such as saltwater intrusion, yet the impacts to their associated reptiles and amphibians have not been assessed. Saltwater intrusions into the upper reaches of coastal rivers contribute to their salinity gradients, which can influence associated plant and animal communities. Our study assessed the reptile and amphibian diversity along a salinity gradient in the upper estuary of the Savannah River to further predictive capabilities regarding herpetofauna. Goals included: inventorying species; determining communities; examining microhabitat use; and modeling reptile and amphibian occupancy to predict the impacts of salinity. We conducted surveys in tidal swamps of the Savannah National Wildlife Refuge during March to June 2016 and 2017 using a variety of methods. Our surveys detected 8 amphibian and 12 reptile species, and we incidentally observed a total of 12 amphibian and 22

reptile species in our study area. Occupancy and community analyses failed to detect any significant trends due to data sparsity. Species richness and diversity generally declined along the salinity gradient, though the observed pattern did not match our predictions. Drivers of the observed pattern were unclear and may be related to landscape-level mosaics of tidal wetland habits. No significant microhabitat associations were detected during the analyses. Regression analyses indicated that a number of species' detections were significantly influenced by soil salinity. Amphibian detections were uniquely influenced by water depths, pH values, and weather conditions. These results expand our understanding of amphibian and reptile species utilizing an understudied, and threatened, wetland type.

2185 - Ripples in the pond: the impact of John Herr's life on botany in the Southeast

Zack Murrell

Appalachian State University, Boone, NC

SERNEC, the SouthEast Regional Network of Expertise and Collections, has grown over the past 12 years well beyond original expectations. As will be demonstrated throughout this symposium, our labor to digitize the 15 million specimens from the 233 herbaria in the region has matured to a stage where scientists and teachers are routinely mining and repurposing the data in many creative ways. When we examine the history of this endeavor, it is important that we acknowledge the seminal efforts that paved the way for this industry. The late Dr. John M. Herr, Jr., a professor of botany for 34 years at the University of South Carolina, should be regarded as a significant force in the development, growth and preservation of the herbarium community in the southeast USA and he deserves substantial credit for the community's health and well-being. Dr. Herr, through his work developing and revising organizational constitutions for the Society of Herbarium Curators, the Southern Appalachian Botanical Society and the Association of Southeastern Biologists, provided a solid foundation for our regional herbarium enterprise. Chris Edmunds wrote that an organizational constitution is the "foundation of high performance and values alignment" and it is clear that Dr. Herr's efforts at development and maintenance of multiple organizational constitutions have had this impact on the Southeast. As we hear about the exciting projects that will be discussed in this symposium it is important to recognize that Dr. Herr's service endeavors in the latter part of his career had extensive ripple effects on scientific and conservation efforts at regional and global scales. As teacher/scholars we need to remind students of the accomplishments of people like Dr. Herr, in order to provide them with appropriate aspirations of how to achieve great things.

2187 - The effect of soil type, liming, and mycorrhizal inoculum on the cultivation of American Ginseng (*Panax quinquefolius)*

Emily Murray, Heather Griscom

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American ginseng (*Panax* quiquefolius) is a perennial herb that is threatened or endangered throughout most of its range, due to overharvesting for its medicinal properties and high profit. American ginseng is now protected in both the United States and Canada, limiting, and regulating harvest of the plant. Restrictions have led to the cultivation of the plant. This greenhouse study examines how soil type (2 levels), liming (2 levels), inoculation (2 levels), autoclaving (control 2-levels) affect plant growth. Two distinct soil types were collected from the field. Stratified American ginseng seeds were planted in cone-tainers in a regulated greenhouse system in a factorial design, with fifteen cone-tainers for each treatment combination. At 7 months seedlings were measured for root length, stem length, leaflet width, above-ground biomass, and percent inoculation. Root lengths were significantly greater in treatments with lime and inoculation (mean= 117.2 p-value<0.001) compared with plants without lime and inoculation (mean=72.9). Stem lengths were significantly greater in treatments with lime and inoculation (mean=59, p-value<0.001) when compared with plants

that were not (mean=52). In addition to lime and inoculation, soil type had an effect on stem length (p-value<0.001). Liming and inoculation combined had a greater effect in poorer soils on both root length and stem length. This indicates that liming and inoculation can help the plants allocate nutrients to the roots and the stem, even in nutrient poor soil. *P. quinquefolius* intentionally inoculated with commercial mycorrhizal fungi could yield larger crops.

2189 - The Genetic Assessment of Bass species inhabiting three lakes in Georgia.

Michael Erwin, Elizabeth Harrison

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Spotted bass (Micropterus punctulatus) and Alabama bass (Micropterus henshalli) are two popular recreational fisheries in Georgia. The native range of the spotted bass (Micropterus punctulatus) in Georgia is limited to the Tennessee River drainage in the extreme North-Central portion of the state including three Tennessee Valley Authority reservoirs: Chatuge (Hiawassee River), Nottely (Nottely River), and Blue Ridge (Toccoa River). The native range of the Alabama bass is limited to the Northwestern corner of the state within the Alabama-Coosa-Tallapoosa (ACT) drainage. However, Alabama bass have been introduced into the Chattahoochee River drainage (Lake Lanier) and are suspected to have been introduced into Lake Chatuge in the Tennessee River drainage. Spotted and Alabama bass are difficult to differentiate in the field based on meristics including scale counts, head shape, scale width, gill raker counts, and tooth patch size. Molecular markers such as the mitochondrial DNA marker, cytochrome c oxidase subunit, CO1, are used in DNA barcoding to genetically differentiate pelagic fish populations. The aim of this study is to assess the genetic diversity of Micropterus inhabiting three southeastern United States lakes by examining haplotype frequencies of COI.

2193 - The effect of non-detection of rare species on IBI scores

Will Commins, Bill Ensign

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The Index of Biotic Integrity (IBI) is a widely used multi-metric index for assessment of the biological health of flowing water systems. However, variation in the occurrence or abundance of rare and/or sensitive fish species may produce significant year-to-year variation in IBI scores unrelated to the biological health of the system being assessed. The apparent nonoccurrence of some species in some years or sites may not be indicative of local extirpation events but instead be due to low detection probabilities. In this study, we assess the effect of variation in rare or uncommon species on within-site, within-in basin, and among year variation in IBI scores. Data drawn from 41 sites in the Chattahoochee, Etowah, and Tallapoosa River basins sampled a minimum of three separate years over the course of a decade will be used to examine the impact non-detection of less abundant species has on IBI scores.

2196 - Assessing functional reproductive biology among floral morphs in *Passiflora incarnata* in Putnam Co., Tennessee.

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Passiflora incarnata is an andromonoecious clonal species native to the southeastern United States. Previous data suggest that there are five distinct floral morphs present on individual plants, three male and two hermaphroditic; each vary in the degrees of gynoecial development. Manipulated outcrosses were performed among three genetically distinct individuals to assess the extent of successful pollen germination, pollen tube presence in the styles, and pollen tube penetration of the ovary for each of the five morphs. Germination on the

stigma surface is possible for all morphs, but pollen tubes are generally absent from the styles and ovaries for the two least developed male morphs. In some cases, pollen tubes were found in the styles but did not penetrate the ovary. Surprisingly, the largest hermaphroditic morph also lacks pollen tubes and ovary penetration. Cross-sections of style tissue confirm arrested gynoecial development in the smallest two male morphs, while the third male and two hermaphroditic morph cross-sections show fully developed tissues. Further investigation into reproductive anatomy is being explored to determine differences between each morph. Potential implications for reproductive ecology are also considered.

2201 - Diversity and Abundance of Meiofauna Taxa with Contributing Abiotic Factors on Nannygoat Beach, Sapelo Island, Georgia

David Turner, Sharon Blackwell, Richard Settele, Andrew Shirley, Logan Young, Nancy Dalman

University of North Georgia, Dahlonega, GA

Meiofauna are benthic marine invertebrates ranging from 50 µm to 500 µm in size. They are vital to the coastal marine food web by serving as primary consumers, food for juvenile species that are both commercially and ecologically valuable, and as detritovores. Additionally, meiofauna are good indicator species for pollution that disrupts ecosystems. Seasonal sand samples were collected from Nannygoat Beach, a beach with limited anthropogenic disturbance, on Sapelo Island, Georgia through 2017. Low, middle, and high tidal zones (measured from mean low tide height) were sampled at three locations along the beach; core samples were split into 0 - 5 cm and 5 – 10 cm depths for analysis. Meiofauna were separated from the sand, identified to the nearest phylum by visual inspection, and then counted. Biotic factors contributing to meiofauna abundance such as chlorophyll concentration and total organic content were measured in addition to abiotic factors such as sand grain size, density, moisture, and the slope of the beach. The most abundant phylum of meiofauna was Nematoda for all locations, zones, seasons, and depths. Gastrotricha, Annelida, Platyhelminthes, and Gnathostomulida were also commonly found everywhere along the beach. Both abundance and diversity were greatest in the middle tidal zone across seasons, sampling locations and tidal zones, despite higher chlorophyll and organic content concentrations in the low tidal zone. Abundance was 3- fold higher during summer as compared to winter. Further, numerous taxa, including Polychaeta and Ostrocoda, were plentiful in the summer but absent in the winter. This study provides valuable information that is relevant to the understanding of metazoan food webs as well as beach disturbances such as pollution.

2203 - The amelioration of grazing and burial through physiological integration by a clonal dune plant

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Clonal plant species that form extensive rhizome networks of interconnected ramets are highly abundant in early successional coastal dune systems characterized by a high degree of environmental heterogeneity. *Hydrocotyle bonariensis* (dune pennywort) is a clonal species that has been shown to manifest the ability to share resources among ramets, allowing whole clones to become physiologically integrated. On the coastal dunes of North Carolina, feral horse populations promote environmental heterogeneity through their grazing and trampling activities. We hypothesized that *H. bonariensis* is able to integrate resources and alter its growth form to compensate for the negative effects of grazing and burial. In two separate experiments, we showed that resource integration within clones allowed *H. bonariensis* to successfully expand into areas of high herbivory and sand burial. The first experiment consisted of clipping portions of *H. bonariensis* to simulate different levels of grazing with half the clones severed to eliminate the possibility of integration. We found that the mean number

of leaves and ramets increased as grazing level increased for integrated clones. Also, integrated clones produced more biomass than severed clones, suggesting that integration allowed the clone to compensate for the negative effects of grazing. Then, to examine the effects of burial, *H. bonariensis* clones in the field were treated with four levels of sand deposition. We found that clones responded to burial by growing vertically through 45 cm of sand, placing new ramets near the surface. This was achieved through resource integration upward from buried ramets. Our research provides further evidence that rhizomatous growth and clonal integration are traits that provide an adaptive advantage to plant species growing in the heterogeneous and rapidly changing coastal dune environment.

2204 - Bird foraging behavior as an assessment of conservation efforts in the South Carolina Upstate

Natalie Ribble, John Quinn

Furman University, Greenville, SC

The portion of the Piedmont ecoregion located in the South Carolina Upstate has been eroded by urban development over the past century and has therefore morphed from a forest biome to a heterogenous forest anthrome. Thus, the efficacy of varied conservation interventions in land management need to be investigated to account for the complex impacts of human systems. Building on concurrent sampling for diversity and abundance, we investigated of foraging patterns as a indicator help to further understand the relationships between birds and their environment. We observed two generalist bird species, the Carolina Chickadee and Tufted Titmouse, across nine forest patches. We observed the foraging behaviors of these species as a function of habitat quality across conservation easements, protected land, and unprotected areas. We found that land management type and patch area result in significantly different foraging patterns. Tufted Titmice spend more time foraging in easements, and less time foraging in patches with a <1,000 square meter area. These results, coupled with data on abundance and diversity, give a unique insight into the quality of the upstate habitat for birds and inspire future ventures.

2206 - Effects of temperature on microbial parameters associated with decaying plant litter in a stream microcosm experiment

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Forested stream networks play a significant role in the storing and processing of terrestrial organic carbon (OC), such as leaves and wood. Fungi are at the forefront of stream OC processing by way of plant litter decomposition, mediating the flow of energy and nutrients to higher trophic levels. Increases in temperature under climate change predictions are expected to affect microbial activity, as well as carbon dynamics in aquatic ecosystems. We performed an experiment in laboratory microcosms simulating stream conditions and measured physiological responses of natural stream microbial assemblages, including fungi and bacteria, to increased temperature. Sterilized leaf disks (*Liriodendron tulipifera*) were inoculated in a stream at the Coweeta Hydrologic Laboratory, NC during peak litter fall. Leaf disks were then incubated at five temperatures (4-20°C) in laboratory microcosms. We determined microbially mediated leaf litter decomposition rates, fungal biomass accrual (from ergosterol), fungal and bacterial production (using radiolabeled tracers), cumulative spore production by aquatic fungi and microbial respiration rates. We found that responses of aquatic litter-associated microorganisms to increases in temperature are more complex than predicted by the Metabolic Theory of Ecology (MTE), with more pronounced responses at lower temperatures. For some parameters, our estimates of apparent activation energy at lower temperatures were considerably higher than canonical values often reported for respiration (0.65 eV) suggesting

that microbial processes in streams during the coldest months could be especially sensitive to temperature increases. These findings will improve our understanding and predictions of how microbial activity and microbially mediated OC processing in headwater stream networks will respond to warming.

2208 - Discovery of Novel Quinoline Derivatives as Psychotropic Agents Using Zebrafish

Reid Loveless, Ashley Williams, Vinoth Sittaramane

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Psychotropic agents are loosely defined as a group of compounds that lead to changes in consciousness, perception, and behavior through chemical alterations of the nervous system. Current psychotropic agents can be used as antidepressants, anesthetics, hallucinogens, mood stabilizers, and anxiolytics. However, despite their numerous applications, almost all psychoactive drugs have the potential to cause serious side effects including paralysis and death. Thus, the discovery of novel psychotropic agents which exhibit high potency and low toxicity remains a high priority. In this study, we aim to determine the psychotropic potential of quinolone-derived compounds, as well as gain a more comprehensive understanding of their modes of action through the employment a zebrafish model system. The initial screening of 20 quinolone derivatives revealed a varying degree of effects and ultimately led to the focus and examination of three potential candidates: 6, 16, 24. Preliminary data show that treated zebrafish larvae exhibit a reduction in motor activity, loss of balance, and failure to respond to touch. As the concentration of the compound administered changes, the degree of behavioral differences observed also changes, indicating dose-dependence. Physiological examinations show that (6 and 16) decrease larvae heart rate, though, are capable of being restored upon washing with E3, indicating the potential of recovery from prolonged exposure to the compounds. Based on the reversibility and short reaction time of observed effect, ion modulation was investigated as a potential mechanism of action. Specifically, CoroNa Green, an ionic indicator dye, was used to visualize the effects of these compounds on sodium transport. Further, we would like to investigate other ions such as calcium and potassium as possible facilitators of the observed effects.

2209 - Using Predictive Modeling Software to Observe the Impact of Land Use Changes on Ecosystem Services

Jasmine Bui, John Quinn

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It is increasingly clear that many conservation challenges are regional or global in scope. Consequently, the data management and processing needs are beyond traditional biological tools. The application of computer science allows for the large amounts of ecological data to be processed into meaningful results. The field of biology benefits from the use of computer science to streamline the process of large data aggregation, manipulation, and modeling. This research demonstrates the integration of ecology and computer science by using InVEST software to model changes in land use and predict its impact on ecosystem services in the Upstate of South Carolina. We used the InVEST Scenario Generator module and associated InVEST models to investigate how land use and land cover change may change to support food production and other ecosystem services. The Scenario Generator uses rule-based probability to project current land cover into a multiple future land cover scenario. We used historical food production data and regional maps along with the scenario maps to represent trends in land use for the Upstate. These models allowed us to identify areas that have the most potential for sustaining food production growth while maintaining natural capital. We found that while tradeoffs between alternative futures are unavoidable, distinct land sparing and land sharing opportunities arise in all scenarios; different scenarios highlight unique potential areas of interest. Because these data are spatially explicit, researchers can use

scenarios to prioritize production opportunities and conservation practices. InVEST Scenario Generator modeling can be used to predict if an area can sustain population growth while maintaining food production and other ecosystem services. Scenarios can be used as a tool to communicate the impact changes in land cover types have on the ecosystem services and environment to local and regional decision makers.

2210 - Zebrafish larvae as a model to understand behavior development

Vinoth Sittaramane, Ashley Williams, Reid Loveless, Shannon Wagner

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Animal behavior is the quintessential culmination of several developmental and physiological processes. Developing embryos are like clean slate where neural circuits are wired in with the help of physiological activities to develop specific behaviors. Thus zebrafish embryonic models offer a perfect scenario to dissect the anatomical, physiological and molecular mechanisms underlying the development of animal behaviors. We have taken a multipronged approach to understand the behavior development in zebrafish. Neural circuits forms the basis for establishing and regulating behaviors. Genetic mechanisms during early neural developmental stages are key to the formation of neural circuits. We have used zebrafish as a genetic tool to identify the role of human autism susceptibility gene *Topoisomerase 3b (top3b)* in neural circuit and behavior development. *top3b* required for spinal motor circuit formation and behavior development. *top3b* mutants display various behavioral deficits such as circling, less exploratory and reclusive behaviors in zebrafish larvae. We have designed novel social, olfactory and tactile behavioral assays to test the role of *top3b* in these complex behavior developmental mechanisms. We have also tested the role of toxicological and physiological mechanisms that can contribute to behavior development. Zebrafish embryos offer a perfect model to test various industrial effluent chemicals and their effect in behavior modifications. We exposed zebrafish embryos to two of the most prominent industrial spills in the past few years. 4-Methyl Cyclohexane Methanol (MCHM) and Tetrakis Hydroxymethyl Phosphonium Chloride (THPC) are chemicals that were spilled in Elk river and Ogeechee River respectively contributing to several aquatic animal deaths and ecological damages. Thus, we tested their role in zebrafish developmental stages and identified that these chemicals contribute to various neurological circuitry defects leading to behavioral deficits. Thus, we have established that zebrafish embryos offer a great vertebrate model for understanding behavior developmental mechanisms.

2216 - Classification of dry coniferous forests and woodlands of the southern Appalachian Mountains

Thomas Wentworth[1], Brooklynn Newberry[2], Michael Lee[2], Robert Peet[2], Michael Schafale[3], Alan Weakley[4]

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Xeric to subxeric coniferous forests and woodlands of the southern Appalachian Mountains with a substantial component of yellow pines (*Pinus echinata*, *P. pungens*, *P. rigida*, and *P. virginiana*) have declined in area during recent decades because of fire suppression, drought, and outbreaks of southern pine beetle. Even prior to widespread decline of yellow pine communities, classification efforts were hampered by their dynamic nature and their tendency to intergrade with a variety of other communities. We have been exploring numerical classification of a data set consisting of over 1,000 permanent plot records extracted from the Carolina Vegetation Survey database, selected using criteria of location in the southern Appalachian region and having at least 10% combined cover of the four yellow pines. Our current focus is on analysis of vegetation data from 333 permanent plots representing 14 US

National Vegetation Classification (USNVC) Associations and the potential need to modify the existing classification structure. We report on the use of fuzzy clustering techniques to revise the *a priori* assignments of plots to Associations and to identify plots representing the core concept of each Association. Subsequent ordinations using nonmetric multidimensional scaling have identified a need to revise the placement of two Associations in the higher levels of the USNVC classification hierarchy. We also address classification of plots not fitting well into existing USNVC Associations.

2217 - Understanding the Role of Ubiquitin during the Elimination of Paternal Organelles in *C. elegans*

Paola Molina, Lynn Boyd

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Ubiquitination is a post-translational modification that regulates distinct pathways such as the cell cycle, endocytosis, transcription and DNA repair. We are interested in understanding whether ubiquitination is required for the strict maternal mitochondrial inheritance observed in most metazoans. There are three highly conserved classes of enzymes responsible for ubiquitination. The ubiquitin activating enzyme catalyzes an ATP-dependent reaction that conjugates ubiquitin onto the enzyme. Ubiquitin is then transferred to the ubiquitin conjugating enzyme (UBC). UBCs have the specific role of determining which type of ubiquitin lysine chain is formed onto the substrate. The final enzyme is the ubiquitin ligase which binds to specific substrates targeted for ubiquitination. Using a transgenic *C. elegans* strain with a GFP::Ubiquitin fusion expressed in the gonad, we conducted a reverse genetic screen to determine which UBC is required for ubiquitinating paternal organelles after fertilization. In nematodes, paternal mitochondria and ubiquitinated sperm derived membranous organelles (MO) are eliminated through autophagy. An initial single UBC RNAi screen and published data suggested the presence of at least two separate ubiquitination events on MOs. Therefore, double UBC RNAi combination knockdowns were tested and the results showed that worms with UBC-18/UBC-16 knockdowns had embryos with reduced MO ubiquitination. Fiesel et al. conducted a screen to identify human UBCs responsible for ubiquitination during mitophagy. They identified, three UBCs that reduced ubiquitination during mitophagy. RNAi of the worm homologues (UBC-18/UBC-13/UBC-2) yielded embryos with reduced MO ubiquitination. RNAi treated embryos with reduced MO ubiquitination were studied to determine the fate of paternal mitochondria. Using live cell imaging we discovered that paternal mitochondria persisted during the 2-cell stage in UBC-18/UBC-16 knockdowns. While, MOs persisted past the 8-cell stage. This talk will provide insight into the pathway involved in the specific ubiquitination of paternal organelles and the downstream consequences resulting from suppression of MO ubiquitination.

2218 - Zoning does not improve the availability of ecosystem services in urban watersheds. A case study from Upstate South Carolina, USA

John Quinn, Melanie Brown

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When making governance decisions, such as land-use plans, policymakers must decide if and how to balance economic growth with environmental conservation. Often, and frequently not by choice, these decisions are made with limited or poor-quality data, which is often either too theoretical or too fine-scale, leading to poor land use planning within urban watersheds. As a case study of a governance technique, we analyzed the function of zoning on the relationship between urban development and ecosystem services across 65 watersheds in Greenville and Spartanburg Counties, South Carolina, USA. Habitat quality, carbon storage, nutrient export, and sediment export were measured using Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST), which maps distributions of ecosystem services based on ecological

production functions. Over a ten-year window, increased development resulted in the loss of ecosystem services. Zoning reduced the impact of development on phosphorus export, but not on other ecosystem services, revealing the need for more explicit consideration of services in future creation of zoning ordinances. If residents of urban watersheds want to benefit from positive externalities, improved and more accessible data and rigorous evaluation, are important first steps towards improved governance decisions about zoning and regional planning in both public and private sectors.

2219 - Modeling the Effects of Noise Propagation

Dakota Howard, John Quinn

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Sound plays a vital role in the environment. The combination of all sounds in a habitat forms the soundscape. Soundscapes are important to understand for conservation and land use planning as they alter animal behavior and affect the health of animals and humans. The goal of this project was to determine how noise from within and around the Greenville Zoo varied over space and time and how it might affect the health of local animals. Sound recorders were placed at five points in the zoo during which dates. In ArcGIS using a toolbox called SpreadGIS, noise propagation maps were created from these five points. The maps showcased how noise propagated out from these points into the rest of the zoo and within the surrounding Cleveland Park. The maps showed how the forests surrounding the zoo absorbed a lot of the noise but the open landscape of the park and the river inside of it allowed the noise to easily propagate through the entire park. The data collected from the recorders was also analyzed in R using TuneR and SoundEcology to determine anthrophony, biophony, acoustic entropy, acoustic diversity index, and other bioacoustics indicators. Variation in these measures was heterogeneous by time and season. Together the data collected shows where it would be valuable to place sound barriers based on where sound comes from within the zoo to control the amount of noise produced. For future applications, this program could be used to create protective sound barriers for the Greenville Zoo as construction has begun within the park that surrounds it. For larger scale projects it can be used to create better urban landscapes that protect local environment from the noise of cities while also aiding in the construction of neighborhoods to protect its residents from outside noise pollution.

2220 - Enhancing undergraduate studies utilizing field stations and study abroad

Danielle Satre, Aliya Davenport

Reinhardt University, Waleska, GA

Using a natural laboratory is not a novel concept, however, incorporating its use along with undergraduate travel abroad is rarely done. Moreover, when most students do travel abroad, they are being led on tours that often resemble sightseeing, rather than studying biology in the field. Undergraduates do not often have the opportunity to see what it is like to be a field researcher. In fact, many of them are not exposed to field work and are unaware of the countless opportunities they have to find their niche in the scientific community outside of the medical field. Our students experienced 3 very different ecosystems in Costa Rica: the rain forest, the cloud forest, and the dry forest. Instead of staying in hotels and taking day hikes to see the sights, students resided in biological field stations, living like real research scientists. Students were introduced to researchers at each field station, received lectures about the work that was being done, and participated in data collection for ongoing projects. This gave students a first-hand look at what it is like to be a research scientist. Students reported learning a great deal on this trip. Not only did they learn course material but they were introduced to the world of field biology and research science. Students were able to gain hands on experience, which opened their minds, and hearts, to the field of research and provided a deeper experience they will not likely forget.

2221 - Cannabinoid Mediated Inhibition of Ovarian Cancer Cell Proliferation is Mediated via Oxidative stress

Bert Crawford, Paul Bagavandoss

Kent State University at Stark, North Canton, OH

I have previously shown that the phytocannabinoids tetrahydrocannabinol (Δ^9-THC) and cannabidiol (CBD) and the endocannabinoids anandamide (AEA) and the metabolically stable 2-arachidonoylglycerol ether (2-AGE) exhibit anti-proliferative effect on SKOV3 ovarian cancer cells. In the present study I have addressed the following questions: 1. Is the antiproliferative effect of cannabinoids mediated via cannabinoid receptors (CB1 and CB2)? 2. Is oxidative stress responsible for the ultimate death of these cells? To answer these questions, SKOV3 cell proliferation with THC and CBD was performed in the presence or absence of antagonists to CB1 (Rimonabant) and CB2 (AM630) receptors, and the presence of oxidative stress was visualized with dyes that fluoresce in the presence of free radicals or reactive oxygen species (ROS). My results suggest that neither antagonist rescued the cells from cannabinoid-induced cell death. While vitamin C and Trolox were not able to reverse the cytotoxic effect of THC and CBD, α-tocopherol did. Thus, the antiproliferative effects of the cannabinoids are mediated through induction of ROS independent of the CB receptors.

2222 - Behavioral responses of physid snails to predators depends on predator diet

Mary Kathryn Wright, Clifton Ruehl

Columbus State University, Columbus, GA

Predators are central to structuring ecological communities through their effects on each other and on prey populations. In this study, we observed behavioral responses of prey to different types of alarm cues in order to better understand the evolution of anti-predator behaviors and their ecological consequences. We used freshwater snails (*Physa acuta*) as prey and giant water bugs (*Belostoma flumineum*) as predators. The experiment consisted of five treatments that separated how chemical cues emitted from a predator (kairomones), fed conspecifics and heterospecifics (damselfly larvae), as well as chemical cues emitted from injured conspecifics (alarm cues) affected snail behavior. We found that snails tended to move out of the water in response to both conspecific and heterospecific prey fed to water bugs. Interestingly, predators that were fed heterospecific prey induced the strongest anti-predator response resulting in the highest number of snails above the waterline.

2224 - Flowering synchrony, floral display, and reproductive success of an alpine cushion plant, *Silene acaulis*

Lucas Piedrahita[1], Ellen Waddle[2], Elijah Hall[3], Grace Kendziorski[2], Megan Peterson[2], Daniel Doak[2]

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Flowering plant populations have various reproductive systems, potentially influencing the effects of different ecological factors on reproductive success. Gynodioecious systems include female plants that only produce seeds and hermaphroditic plants that produce both seeds and pollen. We tested whether floral display and flowering synchrony with conspecific neighbors affected reproductive success, measured by fruit set, of each sex in a gynodioecious species, *Silene acaulis*. Furthermore, we explored how varying the spatial scale (0.5 m, 1 m, 3 m, 5 m, and whole site neighborhoods) of synchrony affected its correlation with fruit set. We observed four sites of this alpine cushion plant throughout the 2016 and 2017 flowering periods at Niwot Ridge, Colorado. We counted open flowers every other day and the total number of flowers and fruits produced at the end of each season for 628 individuals. Female plants had significantly higher fruit set than hermaphrodites. The total number of flowers produced by an

individual was positively correlated with fruit set, suggesting that individuals that produce more flowers are more likely to be pollinated.The correlation between synchrony of flowering and fruit set varied by site, sex, and year but was significant nonetheless, suggesting a complicated relationship between synchrony and reproductive success in this population. Varying the spatial scale by which we calculated synchrony scores had an effect on synchrony's correlation with fruit set in some cases; we recommend that future studies on the effects of flowering synchrony carefully consider the effect of neighborhood size. Understanding the factors that influence the reproductive success of a gynodioecious population clarifies the processes that may influence populations' responses to climate change.

2227 - A Montane Island Plant Digital Collection for Research, Education and Conservation

Kathy Mathews

Western Carolina University, Cullowhee, NC

The WCU (WCUH) and Highlands Biological Station (HBSH) herbaria together contain over 30,000 dried plant specimens and form a regionally significant, historical repository of plants of the Southern Appalachian Mountains, a global plant diversity hotspot. We have created an online, digital collection of montane island plant specimens from WCUH and HBSH, comprising ca. 1,000 vouchers dating from the 1890s to the present, and including five regional montane island communities: rocky summit, granite dome, grassy bald, shrub bald, and spruce-fir forest. These are termed islands due to their unique habitats relative to surrounding areas and their isolation from like communities by distance. Montane island plant communities are significant contributors to the biological diversity of the Southern Appalachians, containing endemics, refugial species, disjuncts, and rare species. In addition, they are especially vulnerable to disturbance from climate change, human recreation, fire suppression, and pollution. Species lists for each community type were obtained from Schafale (2012) and used to create digital checklists with voucher specimens in the SERNEC web portal. All voucher specimens were batch georeferenced using the Geolocate tool in the portal to create distribution maps of each plant community from VA to GA, but focused on NC. The results are comparative inventories of species mapped to each location, with widespread species distinguished from species indicative of an island community. This digital collection leverages the SERNEC resource by enabling users to browse specimens by plant community and to see a list of species found at each site at a point in time. Researchers may study change over time in species composition in relation to available environmental and land use data. Plant species richness may also be compared among island communities relative to size and distance to nearest neighbor. Visual narratives are also being developed on the website for educational outreach.

2232 - Intervention and Impact: the human element of the Southern Appalachian 2016 fires

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In an unexpected confluence of human and environmental factors, the Oct-Dec 2016 firestorm in the Southern Appalachian mountains resulted in loss of life, loss of homes and expenditures of more than $150m in suppression alone. Drought and changes in forest and fire management as well as structural development over the last few decades have altered available fuels, fuel breaks, treatment possibilities, and number of people living in fire-prone landscapes. We examine the trade-offs between the costs of forest and fire management and development and the outcomes of suppression and damages. We quantify and monetize, to the extent possible, these tradeoffs in fuels management, prescribed fire, prevention, interface development, suppression expenditures, structural losses, morbidity and mortality, health impacts and expenditures, infrastructure losses, and regional economic costs and losses. We

also explore the links between the pre-fire actions and expenditures, and, the impacts and expenditures during and after the wildfires.

2235 - Environmental and phylogenetic effects on the dermal microbiome of Mobile basin sculpin (Teleostei: *Cottus*)

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The sculpin family (Cottidae) ranks among the lesser-known taxa comprising a freshwater biodiversity hotspot in the Mobile River Basin. Morphological conservatism among sculpin species has confounded efforts to resolve alpha taxonomy, to the extent that most recent descriptions have relied heavily on molecular phylogenetics. Eastern Cottus species are important water quality bioindicators, but this sensitivity to anthropogenic stressors correlates with relatively high extinction risk. This risk imparts a need to understand the physiological mechanisms associated with stress response, including protection from environmental pathogens. A relatively new area of study in fishes is the dermal mucosal microbiome. The importance of microbes within the human dermis has been well documented, but the dermal mucosa (slime) of teleosts represents an unexplored microscopic ecosystem. We investigate the microbial flora of these fishes to discover correlations among microbiome, host genetics, and environment while also examining the phylogenetics of known Mobile Basin populations. This study looks at the microbiome of the four recognized species/subspecies within the Mobile Basin and how they group within the Uranidea clade, while also examining the alpha diversity among the different populations. Two of these populations occur at the extreme southern reaches of the habitat range and are focused on for ecological and geographical significance. These populations may be most important in regards to conservation efforts.

2236 - Correlations between the Serotonin Transporter (SLC6A4), Harm Avoidance, Excessive Alcohol Consumption and Extreme Sports in a population of College Students.

Erica Giron[1], Ogechukwu Otiji[1], Matthew Schmolesky[1], Jill Penn[1], Jennell Talley[2]

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Serotonin is a neurotransmitter that affects mood and social behavior. Fluctuating levels of serotonin may influence an individual's risk taking behavior, in part, because serotonin has been linked to harm avoidance (HA), a personality trait described by Cloninger (1993). HA is characterized by fatigue, shyness, constant worry, and fearfulness of uncertainty and appears to influence one's inclination to engage in risky behaviors such as extreme sports and excessive alcohol consumption. Additionally, the serotonin transporter has a polymorphic region called 5-Hydroxytryptamine Transporter Gene-Linked Polymorphic Region (5-HTTLPR) that has an influence on human behavior. The most common 5-HTTLPR polymorphisms are composed of either a fourteen (S allele) or a sixteen (L allele) repeat of a 22 bp nucleotide sequence. The "L" variant increases the amount of serotonin transporter expressed, resulting in decreased serotonin at the synapse, while the "S" variant has the opposing effect. Students from Georgia Gwinnett College completed Cloninger's personality inventory and surveys on risk behavior and risk assessment; they also provided a DNA sample for genotyping. Our study explores correlations between HA, participation in extreme sports and/or heavy alcohol use, and the 5-HTTLPR genotype. Data suggests a negative correlation between HA and routine participation in extreme sports ($r = -0.33$, p-value<0.01), but no correlation between HA and heavy alcohol consumption or between routine participation in extreme sports and heavy alcohol consumption. Further analysis demonstrated a negative correlation between HA and frequent participation in rock climbing, the most practiced extreme sport among GGC students ($r= -0.207$, p-value< 0.01). To date, we have not discovered any correlation with genotype and HA. Nor does there appear to be any correlation with genotype and participation in extreme

sports, or heavy alcohol use (n=65). We are continuing to analyze genotypes; by the time of the presentation, updated results will be presented.

2238 - The role of recent and past fires in shaping the vegetation of Great Smoky Mountains National Park

Julie Tuttle, Peter White

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A history of natural and human-set fires has contributed to the topographically complex vegetation pattern and species distributions in Great Smoky Mountains National Park. Historical vegetation maps illustrate a patchy distribution of fire-adapted yellow pine and oak forests on ridgetops and south-facing slopes at low to mid elevations, particularly in the western end of the Park dominated by ridge and valley topography. When the Park was formed in the 1930s, human-set fires were excluded, and natural fires were suppressed for decades, resulting in altered structure, composition, and distribution of these forests. In November 2016, strong winds during a period of extreme drought enabled the Chimney Tops 2 fire to rapidly burn 11,410 acres in a north-facing watershed of the Park. This presentation will review the role of fire, and the absence of fire, in shaping the distribution of fire-adapted forest communities and tree species in the Park, based on a comparison of park-wide vegetation plot data from the 1930s and the 1990s-2000s. Topographic patterns of vegetation and fire severity within the perimeter of the Chimney Tops 2 fire will be considered in the context of Park-wide vegetation pattern and change, and renewed questions about past and future fire-vegetation dynamics in this region will be discussed.

2241 - Comparing Bass Species within Lake Chatuge and Lake Blue Ridge

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Spotted bass (*Micropterus punctulatus*) and Alabama bass (*Micropterus henshalli*) are the two most common subspecies of bass in Georgia. The native region of spotted bass is limited to the Tennessee River drainage, including Lake Chatuge, Nottely and Blue Ridge, while the Alabama Bass is more prevalent within the Alabama-Coosa Tallapoosa drainage. Alabama Bass has been presumed to be introduced in the Tennessee River drainage. The presence of the Alabama Bass in the Tennessee River drainage should be reflected in mitochondrial and nuclear genetic markers. Cytochrome Oxidase 1 (COI) and 15 microsatellite loci were used to identify Spotted bass and Alabama bass inhabiting Lake Chatuge and Blue Ridge. The results revealed that each lake contained Red Eye Bass (*Micropterus coosae*), Alabama Bass (*Micropterus henshalli*) and Shoal Bass (*Micropterus cataractae*). Tajima's D and Fu's statistic were used to evaluate neutrality within populations. Microsatellite analysis was also conducted to assess genetic structuring in each lake and provide a more powerful molecular analysis of bass species residing in each lake.

2245 - A Genomic Assessment Of Diversity Within Watedogs (*Necturus*)

David Beamer

Nash Community College, Rocky Mount, NC

Waterdogs (*Necturus*) are completely aquatic, paedomorphic salamanders distributed across the eastern United States. There are presently five or six species recognized by most authorities, however the number of species and species assignment of many populations has been problematic. To address the systematics and evolutionary history of these salamanders I sampled populations from each independent river drainage across their range. From each population I collected genomic data (~400 loci) and used this data to reconstruct a phylogeny

within a likelihood framework and to produce an ASRAL species tree. This data reveal extremely limited divergence between populations including those currently recognized as different species. This result is surprising because many of the river drainages have entered the ocean independentlyfor long periods of time and which seems at odds with the patterns detected in this data set. Usually limited genetic diversity is interpreted as being due to gene flow or recency of inhabitation. The biology of *Necturus* makes both of these unlikely scenarios and I present an alternative hypothesis that might explain the low genetic diversity detected in the present study.

2247 - Structural Components in Sucking Mouthparts of Insects

Alison Arling[1], Suellen Pometto[2], Charles Beard[2], Peter Adler[2], Konstantin Kornev[2]

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Fluid-feeding insects have specialized mouthparts for fluid uptake. These mouthparts, or proboscises, are often prehensile organs and have a robustness and an ability to sense the environment. We have examined Lepidoptera and Diptera to understand the structures involved in the feeding organs, focusing on engineering applications. We used light microscopy to investigate these structures. Specimens were prepared based on standard histological protocols with some modifications. For example, we used tert-butyl alcohol instead of ethanol for dehydration, and we tested multiple ways to embed specimens for sectioning. This is because the cuticle of insects is tough and is further hardened by some histological methods. The external cuticle has linking structures (legulae) that appear to have a different density than the rest of the cuticle. The legular bands also have porosity that is important in fluid feeding. Other thick cuticular structures are also present. The tracheae have thick walls to prevent collapse as they carry gases to distant points. They also must be flexible to bend with the prehensile proboscis. The food canal is also resistant to collapse but flexible and variable in shape and size. The softer inner parts of the proboscis reveal a large nerve bundle. Muscles appear in the lumen of each half of the proboscis. The lumen also has hemolymph in living specimens, which might hydrostatically enhance movements of the proboscis. We are now beginning to understand the remarkable engineering aspects of proboscises, which in the past have been viewed as simple straws.

2249 - The effect of exotic plant species on arthropod diversity within an urban temperate deciduous forest

Christien Jackson, Darlene Panvini

Belmont University, Nashville, TN

The invasion of exotic plant species has the potential to influence the arthropod biodiversity of terrestrial habitats. However, the degree to which they could impact diversity is not fully known, especially in urban environments. This study examined levels of arthropod biodiversity in plots with varying amounts of native *Acer saccharum* and the exotic shrubs *Lonicera maackii* and *Ligustrum vulgare.* Arthropods were collected in an urban forest in three plot types: plots dominated by exotic plants, with intermediate levels of exotics, and with no exotic plants. A combination of pitfall traps and branch beatings were used to collect specimens. Specimens were identified to family and diversity indices determined. A total of 430 individuals, representing 30 families were identified. The Jaccard Index of Similarity was 23.8% among the plot types. Plots with high levels of exotic plants had fewer individuals and moderate amounts of diversity. Native plots had the most individuals but lowest diversity. Mixed plots had the greatest diversity suggesting that intermediate disturbances, due to the occurrence of invasive species, may influence levels of arthropod diversity. This research will provide information on the effects of exotic plants on arthropod abundance and diversity, with implications towards management.

2255 - Preliminary investigation into the taxonomy of the *Clematis viorna* complex (*Clematis* subgenus *viorna*) of the southeastern United States.

Zach Irick, Dwayne Estes

Austin Peay State University, Clarksville, TN

Clematis subgenus *viorna* of the southeastern United States has been the subject of much taxonomic confusion with many disparities about what constitutes the best delineation of "*Clematis viorna*." Numerous authors within the last 50 years have contributed to *Clematis* alpha taxonomy, and species concepts are continuing to be refined, with several new locally endemic species having been described recently: *C. carrzioensis, C. morefieldii, C. socialis, C. vinacea*. Despite recent publications highlighting the significance of new species discovery within *Clematis* subgenus *Viorna,* the overreliance of herbarium specimen study has confounded *Clematis* taxonomy and is likely the culprit behind several undescribed and narrowly endemic taxa being overlooked. This project aims to reassess the taxonomy of the *Clematis viorna* complex utilizing a multi-disciplinary approach with a heavy emphasis on common garden experiments, extensive fieldwork throughout the eastern U.S., herbarium study, morphometric analyses, and ecological study. The ultimate goal of this project is to circumscribe the *Clematis viorna* complex to include an additional 3-5 new taxa and to resurrect multiple taxa that were recognized by past taxonomists but that have been buried in synonymy.

2268 - The Southeastern Grasslands Initiative (SGI): Charting A New Course for Conservation in the 21st Century

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The southeastern U.S. grasslands (savannas, prairies, glades, barrens, balds, bogs, fens, meadows) are imminently threatened. The Southeastern Grasslands Initiative (SGI) (Clarksville, Tennessee), aims to establish itself as a clearinghouse to prioritize and focus conservation efforts across a 21 state region. SGI will use a multi-faceted approach combining restoration, preservation, recreation, research, rescue, seedbanking, education, and market-driven strategies relying on teams of volunteers guided by regional coordinators. SGI is currently working with and seeking support from private philanthropic foundations, corporations, non-profit conservation organizations, and government agencies to launch SGI by 2018.

2270 - Navigating the learning curve for students and the professor as we shift from traditional professor-led instruction to a more student-centered, student-engaging learning approach in biology education

Valarie Burnett

Newberry College, Newberry, SC

Vision and Change in Undergraduate Biology Education: A call to Action, released by the American Association for the Advancement of Science in 2011, calls for a movement from traditional professor-led instruction to student-focused, active learning strategies. Inspired by these initiatives, I incorporated more student-centered instructional methods into my courses, particularly in a two-semester sequence of Anatomy and Physiology. Over the past few years, I have added many activities designed to encourage student engagement, inquiry, and critical thinking, improve communication and meta-cognition, and foster lifelong learning. These activities include problem-solving exercises and case studies, concept-related games, literature review and primary research, and student-led instruction. I assessed outcomes of these strategies and previously reported that there was an increase in the percentage of As

and Bs on tests corresponding to the shift from primarily professor-led instruction to more student-centered learning methods. Assessment of new and previous data shows there is also a decrease in the frequency of Ds and Fs, with the incorporation of a student-centered learning approach. Vision and Change advocates replacing professor-led teaching with student-led self-instruction. Until recently, I have taken a more conservative approach and blended professor-led introduction of concepts with student-led activities and applications. However, in the past year, I have shifted much more instructional responsibility to the students, enhancing active-learning and encouraging students to be more hands-on and self-sufficient in their own educational process. Student feedback and a slight decline in test scores suggest my original approach of blending professor-led instruction with student-centered active learning may be a more effective learning strategy for some students.

2277 - Mesopredator and human presence on a barrier island during sea turtle nesting season

Rachael Urbanek, Zachary Taneyhill

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Red fox (*Vulpes vulpes*) management has been conducted on Masonboro Island National Estuarine Research Reserve, North Carolina, since 2013 to reduce depredation on loggerhead sea turtle (*Caretta caretta*) nests. Depredation rates have varied among years indicating either an influx of red fox onto the island post cull or other mesopredators preying on sea turtle nests. We investigated the presence of red fox and other mesocarnivores on Masonboro Island after the 2016 culling event to try to characterize mesocarnivore behavior and interactions during the turtle nesting season. We systematically placed 17 Moultrie® panoramic 150 game cameras every 0.80km along the base of the dunes on the shoreline of Masonboro Island during May–October 2016. Of 81,509 pictures taken by the cameras, we observed 2 red fox and 1 Virginia opossum (*Didelphis virginianus*). There were no documented fox predation events on turtle nests in 2016 and the number of false crawls was lower than the previous 5 years. Given that we only recorded 3 pictures on 2 different nights of mesopredators, our results may indicate that the 2016 cull was successful. Mesopredators, especially red fox and raccoons, on the mainland may temporarily shift their home range during the onset of the turtle nesting season to procure food for their offspring. By early fall, most mammal offspring disperse and likely recolonize the island annually. Human and domestic dog present on the island is abundant and also may influence turtle nest success.

2285 - A new interpretation of chronological ages of *Latimeria chalumnae* and other coelacanths

Frances Woolfolk[1], Michael Newbrey[1,2], Hugo Martín-Abad[1,3], John Maisey[4]

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There is little in the published literature on age assignments of coelacanths. From previous literature, coelacanth scales were used to measure age, suggesting different hypotheses of longevity: 20 years old and 40 years old. A recent hypothesis suggests a 100-year life span from a 21-year *in situ* study where larger individuals had little to no growth. Previous studies also suggest 3 years gestation period based on the study of embryos found in a *Latimeria chalumnae* female. The largest known individuals grow to 1.8 m TL, which is their maximum size. Our objective is to determine the number of years it takes to attain maximum size. Previous studies have failed to describe growth cessation marks adequately. We used new criteria to identify growth cessation marks on scales of extant (*Latimeria chalumnae*) and extinct (*Axelrodichthys araripensis*) individuals. New age assignments for *L. chalumnae* resulted in higher individual ages than previously noted in the literature. We compared chronological ages of scales and bones in *A. araripensis* and found that they agree. Our age

assignments suggest a life span that exceeds 40 years, but we cannot refute the 100 year life span hypothesis. The results suggest that coelacanths grow much more slowly than previously reported. This study provides new numerical data that supports the idea of low metabolic rate and slow growth.

2297 - Putting Arkansas on the map: Georeferencing Arkansas herbaria

Diana Soteropoulos, Jennifer Reed, Dylan DeRouen, Travis Marsico

Arkansas State University, Jonesboro, AR

In 2014, Arkansas's eight herbaria received a SERNEC grant from NSF to digitize specimens collected within the state. Digitization includes multiple steps: imaging specimens, databasing specimen label information, and georeferencing locations. About 150,000 Arkansas specimens (75%) have been imaged by students. Citizen scientists through Notes from Nature have databased over 6000 records from images in a three-part expedition "Plants of Arkansas: The Delta and Crowley's Ridge Flora." Now, students at Arkansas State University (A-State) are georeferencing these records. Georeferencing historic collections, prior to GPS technology, can be challenging, but high accuracy location information allows new research capabilities using the state's flora, including determination of potential research sites, finding understudied areas, and changes in species' ranges over time. Three of the most understudied counties in the Delta region – Crittenden, Mississippi, and Poinsett – are being inventoried by A-State graduate students. We will also be conducting floristic surveys of tallgrass prairie remnants and the only known saline barrens in the Mississippi Alluvial Plain. These projects will contribute greatly to our understanding of the current state of floristic richness and continue to build the SERNEC database.

2310 - An examination of UV radiation tolerance and photoenzymatic repair capabilities across temperature in the freshwater cladocerans Scapholeberis mucronata, Diaphanosoma birgei, and Moina spp

Harrison Seitz, Sandra Cooke

High Point University, High Point, NC

Ultraviolet (UV) radiation has multiple consequences to freshwater organisms. Some zooplanktons use photoenzymatic repair (PER), which is a process that utilizes ultraviolet-A and visible light (photorepair radiation, PRR) to repair ultraviolet-B-induced DNA damage. Some zooplanktons also repair damage via nucleotide excision repair (NER), which is a radiation-independent enzymatic process. Our objective was to determine the effects of UV radiation, including the use of PER and NER on the cladocerans *Diaphanosoma birgei, Scapholeberis mucronata*, and *Moina* spp. Based on studies with *Daphnia*, we hypothesized that the use of PER and NER varies with temperature and across species. The three taxa were exposed to UV-B radiation followed by photorepair radiation (+PRR) or no photorepair radiation (−PRR). The occurrences of PER and NER were determined indirectly by monitoring the survival and reproduction after exposure. Experiments were performed at 10, 15, 20, 25, and 30 °C. *S. mucronata* and *Moina* spp. use PER effectively at all temperatures, whereas *D. birgei* uses PER less effectively and only at warmer temperatures. *S. mucronata* and *Moina* spp. use NER more effectively at colder temperatures, while *D. birgei* uses little to no NER. These findings have implications on how these organisms may adapt to changing UV and thermal conditions.

2311 - Taking Chances, Getting Messy, and Making Mistakes: Taking Cues from Ms. Frizzle to Teach Critical Thinking to Environmental First Year Students

Stephanie Jeffries

NC State University, Raleigh, NC

First-year students frequently lack the critical and creative thinking skills needed to be successful in college and beyond, and often arrive on campus unsure of their academic pathways. The pilot Environmental First Year Program launched in Fall 2017 with 79 students in 10 different environmentally-related majors across 3 colleges, to give students the opportunity to explore different fields with a new high-impact course, Exploring the Environment. More than a dozen faculty members and professionals team-taught six case studies focused on the "wicked problems" they tackle in their fields. Hands-on field experiences, service-learning, plus encouraging students to work together and take risks in their problem-solving, pushed students to grapple with difficult and complex questions. Additionally, we used a number of pedagogical approaches to teach critical and creative thinking skills. Students wrote short reflection papers at the conclusion of each case study that were evaluated using selected intellectual standards. At the end of the semester, students combined several critical and creative thinking strategies to connect the course themes and with their personal academic interests to map out their academic paths going forward.

2314 - Building large digitization teams to achieve high digitization throughput of herbarium specimens.

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There are approximately 650,000 herbarium specimens that reside in Tennessee. As part of the SERNEC effort, specimen images and skeletal specimen data (herbarium acronym, barcode number, scientific name, state, and county) were collected during a 19-month period from June 2016-December 2017. At least 250,000 of these were digitized at the University of Tennessee at Chattanooga (UTC). This represents a significant data set for analyzing strategies, performance rates, training time, and other aspects that might be useful for initiating or modifying digitization workflows. In all, 37 students from UTC were employed or spent research credit hours on this effort. All students were introduced to the project through classroom exercises. These classroom experiences served as test cases from which to select and invite research credit hour students to join the team. In turn, these students served as a population pool from which to ultimately choose paid workers. Finally, paid students also served as team leaders and trained incoming students. Herbarium specimen digitization was divided into three tasks: barcoding specimens, imaging specimens, and databasing specimens. Students could segregate into the tasks they most preferred, or we would suggest tasks based on their weekly rates. The highest performers for these three tasks achieved overall rates of 6.56, 4.84, and 4.33 specimens/minute, respectively. In the end, we averaged 1.57 specimens/paid minute of work per student. Each specimen cost $0.10 of student salary to digitize (not counting overhead or faculty salary). Specimen digitization throughput ranged from 2400-4400 specimens per week. The efficient UTC team also trained students at other Tennessee university herbaria, and these insular case studies in herbaria of different sizes allowed us to compare how herbarium size influences potential rates of digitization.

2316 - Biogeographic distribution of spotted wintergreen (*Chimaphila maculata*) and its application to human skin health

Erin Moore[1,2], Elizabeth Bickenbach[1,2], Charles Wagner[2], Jessica Alley[3], Thirumurugan Rathinasabapathy[2], Slavko Komarnytsky[2]

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Mobile Discovery program provides a low-cost approach to explore chemical diversity of local ecosystems and discover its potential to improve human health. As a part of this program, we identified spotted wintergreen (*Chimaphila maculata*), a native Southern Appalachians plant of

cultural significance to the Eastern Band of Cherokee people, as a botanical source of bioactive quinones, terpenes, and phenolic glucosides with potent antimicrobial and anti-inflammatory properties. Preclinical testing in skin fibroblast and macrophage cell cultures showed high skin regenerative potential of spotted wintergreen preparations via significant and consistent modulation of NF-kB and TGF-b signaling pathways, as confirmed by qPCR array profiling. Based on this data, we developed a novel topical skin care formulation potentially effective at alleviating cutaneous infections and disorders associated with abnormal skin regeneration.

2317 - Mobile Discovery: In search of new antibiotics in classroom and field settings

Elizabeth Bickenbach[1,2], Erin Moore[1,2], Charles Wagner[1], Mickey Wilson[1], Slavko Komarnytsky[1]

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Spread of the multi-resistant pathogenic bacteria and empty antimicrobial pharmaceutical pipelines highlight a critical need for discovery of new effective antibiotics. The costs and time associated with large antimicrobial screening efforts cause individual research units to reduce numbers, frequency, or sample sizes, thus resulting in diminishing throughputs and outcomes. Mobile Discovery program (http://MobileDiscovery.org) circumvents these challenges by distributing inexpensive ($1) screening kits to multi-institutional collaborative networks, schools, and individuals interested in antibiotic discovery from natural sources that work worldwide to screen and report antimicrobial activity using uniform community standards for data collection and sharing. By combining hands-on science (biodiscovery), information management (data reporting), and educational (training materials and manuals) components, the Mobile Discovery program promotes STEM involvement through educational innovation, increases interdisciplinary scholarship, and provides exceptional local and global long-term engagement in global health research.

2424 - **Workshop: Developing Research-Infused Curricula for Undergraduates**

Jennifer Rhode Ward[1], Alisa Hove[2]

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Faculty from four liberal arts and masters'-granting institutions have developed inquiry-driven curricular modules focused on assessing plant ecological responses to global change in the Southern Appalachians. This place-based educational network utilizes regional environmental issues to impart botanical knowledge while encouraging higher-order cognitive processes, advancing quantitative literacy, teaching analytical techniques, honing scientific communication skills, and improving persistence and graduation in STEM majors. Our collaboration is based on the notion that students meaningfully engage with STEM when motivated and challenged by the process of working on real projects whose findings may extend beyond the classroom. In this workshop, we will share classroom and laboratory exercises that use authentic inquiry to generate publishable data; these have been shown to increase student understanding and engagement, and to develop knowledge bases. Workshop participants will discuss strategies for securing internal institutional support for research-infused curricula. Finally, the workshop will guide participants as they develop new CUREs (course-based undergraduate research experiences), related to their own areas of scholarly expertise.

2427 - Science in a Post-Truth World

Jane Lubchenco

Oregon State University, Corvallis, OR

Science and society are inextricably linked. However, recent, high-profile examples of anti-science rhetoric, discounting of scientific evidence, and the emergence of populism appear to reflect a widening gap between science and society. In fact, in 2016 The Oxford English Dictionary declared "post-truth" to be its "Word of the Year". Against this backdrop and drawing on her personal experiences as the Under Secretary of Commerce for Oceans and Atmosphere and the Administrator of the U.S. National Oceanic and Atmospheric Administration (NOAA), the first U.S. Science Envoy for the Ocean, and decades of scientific research around the world, Dr. Lubchenco will discuss the ways in which scientists can help reshape the conversation through engagement and public understanding. Dr. Lubchenco believes that the science community must engage more vigorously with society and increase public understanding to address problems, find solutions, and help create a better future for us all. She will use numerous examples from scientific information and engagement in coastal habitats and communities.

2431 - Using the Motus wildlife tracking network to study avian migration pathways through the southeastern United States

Kara Lefevre[1], Adam Smith[2]

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The global study of migratory birds is being boosted by technological advances such as public databases and the use of geolocators, increasingly miniaturized GPS loggers, and other tools. To wit, Motus is an automated radiotelemetry network that is enabling powerful new insights about the routes, rates, and stopover behavior of individual migratory organisms. The workshop will share knowledge about how the Motus network is augmenting knowledge via its hemispheric collaboration among government scientists, academics, non-profit organizations and citizens. We will explore how the southeastern USA figures prominently in the migratory connectivity of New World landbirds, yet the region is poorly represented within the current footprint of Motus receiving stations. This is relevant because landscapes around the Gulf of Mexico and the Southeast Atlantic Coast provide habitats and connectivity for Nearctic–Neotropical migratory landbirds that travel between their North American breeding grounds and tropical wintering grounds in the Caribbean and Central and South America. A better understanding of migration ecology throughout the southeast will help efforts to conserve those birds. The workshop will share updates about current Motus efforts in the southeast, and will provide logistical advice to researchers interested in getting involved in Motus by establishing a receiving station or affixing nano-tags to migratory animals for studies of movement ecology. Bringing a laptop would be helpful, but not mandatory.

2432 - Workshop: Advantages and Challenges of Starting a National History Collections Club (NHCC) at your Institution

Travis Marsico

Arkansas State University, Jonesboro, AR

The NHCCN is focused on generating and maintaining student interest in biodiversity collections by providing them access to curators and mentors and to other students with similar interests. The purpose of a multi-institution network is to increase accessibility of intellectual resources for club advisors and graduate and undergraduate student members. Through their involvement with Natural History Collections Clubs (NHCCs), students are empowered to take leadership roles in their universities' natural history collections. The current network is made of several clubs that are curator-advised, student-driven organizations aimed at enhancing local natural history collections by helping to train student volunteers to assist in curating and managing them. This workshop will explore the advantages and challenges of starting a NHCC at your institution as well as other strategies for getting students more involved in collections.

2478 - Identifying and examining potential bacterial pathogens in a rural, Alabama primary elementary school

Jason Floyd

University of North Alabama, Florence, AL

It is well known that bacteria contribute to the onset of illnesses among young children in the public education system through interpersonal contact among students. However, another likely cause of rapid disease transmission is poor air ventilation and filtration, which decreases a building's indoor air quality (IAQ). The goals of this Sick Building Syndrome (SBS) study are: 1) collect air samples from a rural, Alabama primary elementary school (School P), 2) identify which bacteria are present in the air samples, 3) determine the relative number of bacteria per cubic meter in School P, and 4) assess the antibiotic resistance of the identified bacteria. Air samples will be collected and bacterial cultures will be grown on either bacterial specific media. Once cultures have been isolated they will be identified using the Biolog GEN III Microbial Identification System. A formula for colony forming units per cubic meter (CFU) will be used to assess the number of microbes collected within School P. Antibiotic resistance will be tested with each microorganism identified using a Kirby-Bauer antibiotic susceptibilityprotocol. Results obtained from the study will help School P improve its indoor air quality (IAQ).

2482 - Baseline biodiversity of the terrestrial and aquatic biota in an undisturbed hardwood forest slated for road construction.

Emily Rabjohns, Levi Thomas, Sarah Edmonds

William Peace University, Raleigh, NC

Our research site comprises a patch of old hardwood forest in Wake Forest, NC with a small second order stream. The unnamed tributary runs into Smith Creek, which drains into the Neuse River. Road construction is planned to transect the property in 2018, which provides a unique opportunity to determine the impact of construction on this site. We surveyed the creek and adjacent land 100 meters on either side to survey the biodiversity of macroinvertebrates, fish, amphibians and reptile populations. We also tested the water for oxygen, pH, nitrates, phosphates, chlorine, and ammonia-nitrogen. Although water chemistry analyses yielded normal ranges for the Central Piedmont region, the macroinvertebrate diversity was lower than expected. Notable siltation from residential construction nearby may have affected the biota. Dominant species were pollution-tolerant caddisflies, mayflies and dipterans. The most common invertebrate species was the crayfish, *Cambarus latimanus.* Fish populations were dominated by creek chubs (*Semotilus atromaculatus*) and rosyside dace (*Clinostomus funduloides*). *Semotilus* are highly adaptable and tolerant of silt and pollution. We expect this species to endure change from construction fairly well. *Clinostomus* is a sensitive species that is intolerant of turbidity and silt and typically thrives in clear, cool water in forested areas, so deforestation and siltation from construction should adversely affect their population. Amphibian and reptile species were fairly abundant despite the running and mountain bike trails that have fragmented the site and reduced organismal movement. Given the extensive recreational use, the number and diversity of amphibian and reptile species were good. These data will serve as a baseline to determine the impact of road construction on the biodiversity of the site, which we plan to monitor throughout the construction and for at least a year after completion to determine the long- term effects on the residential populations.

2483 - The Effects of Nicotine on the Expression of *CHRNA3* in Correlation to Chronic Obstructive Pulmonary Disease

Kaitlynn Stowers, Dr. Christine Fleet

Emory & Henry College, Emory, VA

Researchers are studying whether there is correlation between gene expression and the development of Chronic Obstructive Pulmonary Disease (COPD). Understanding gene expression patterns in the gene CHRNA3 (Cholinergic Receptor Nicotinic Alpha 3) has been on the forefront of developing a deeper awareness of leading risks factors for COPD. This study uses NIH/3T3 Mus musculus cells exposed to nicotine concentrations over varying time lengths to develop a better understanding of the genetic impact of nicotine exposure. Nicotinic concentrations of 1μM, 10μM, 25μM, and 50μM were administered to cells for up to 48 hours. qPCR was used to identify CHRNA3 expression in treated versus untreated cells. Results indicated that at a concentration level of 10μM, CHRNA3 expression was upregulated. Since this gene has been associated with COPD development, my data suggests a correlation between nicotine exposure altering CHRNA3 expression, which could contribute to the onset of COPD.

2487 - The effect of disturbance on vegetative community structure and diversity: A comparative survey

Ashley Desensi

4225 University Ave, Columbus, GA

Disturbances, human or natural, are known to have adverse effects on community diversity and stability. In order to assess the effects of disturbance (and other possible factors which contribute to the health of an area), researchers use ecological surveys. These surveys provide important information about the overall health of a community. This study proposes to characterize the flora of two predominantly hardwood forests located in Harris County, Georgia. The study sites were selected based on their close proximity, and vast differences in community structure. The collected data was analyzed and assessed to provide a full picture of the conditions of each habitat. Results revealed variations in relative abundance of selected species and differences in overall community structure between the two sites. Tree species diversity and age distributions also varied greatly between sites.

2501 - Novel etoposide analogs inhibit the growth of cancer cells in culture

Priyanka Kumar[1], Amber Bradley[2], Joe Deweese[2], Chris Barton[1]

[1]Belmont University, Nashville, TN, [2]Lipscomb University, Nashville, TN

2506 - Characterization of a novel mouse model to study IL-3 expression

Chandler Parker

Bridgewater College, Bridgewater, VA

Malaria is caused by a protozoan parasite. Previous studies in our laboratory using a murine model of malaria have indicated that malaria-infected mice lacking the protein interleukin-3 (IL-3) (KO mice) survive better than malaria-infected mice with the IL-3 protein (WT mice). Furthermore, IL-3 KO mice produce less of the inflammatory cytokine interferon-gamma (IFN-g) early during infection than the WT mice. This would indicate that IL-3 is either directly or indirectly regulating IFN-g expression. In order to determine the role of IL-3 in malaria pathogenesis, we developed a novel mouse model using CRISPR technology. In this mouse whenever the IL-3 gene is expressed, a ZSGreen fluorescent protein gene is expressed as well. Therefore, we can use this mouse to determine which cell types are secreting IL-3 using fluorescent technology such as flow cytometry or immunofluorescence. This talk will focus on data characterizing this new mouse model.

2508 - Structure-to-function relationships of iron- and manganese-lipoxygenases

Claire Fabian-Bayola

East Carolina University, Greenville, NC

Lipoxygenases (LOXs) are enzymes that catalyze the (per) oxidation of unsaturated fatty acids. They serve as the beginning of cellular signaling steps that cause inflammatory responses by the production of leuktrienes and lipotoxins, both of which can attribute to the development of asthma, cancer, and arthritis in humans. To initiate the necessary biochemical reactions, lipoxygenases possess an iron center (SLO) but organisms in the Fungi kingdom use manganese (Mn-LOX). It has been found that Mn-LOX can interchange iron and manganese to their needs, but SLO that is found in plants and humans cannot. So far, when substituting manganese into natural SLO's, there has been no functionality. This is possibly due to the differences in redox potentials. Through site mutagenesis, residues at the active site and first (and second) shell ligands are being replaced or deleted to determine their effect on enzyme activity. If the iron substituted into native Mn-LOX produces a functional enzyme, kinetics will be measured through electropotential probes and samples will be prepared for structural analysis using X-ray crystallography. This could be a stepping stone to the expansion of biomedical technology and a better understanding in inflammatory responses in humans.

2512 - Forensic Anthropology

Michaela Mays

Gardner-Webb University, Boiling Springs, NC

Forensic anthropology techniques are reviewed and examined for accuracy in crime scene investigation cases. There are many techniques used to investigate a crime scene. These include sex estimation, age estimation, wound trauma, among others. Peer reviewed articles were used to determine the accuracy of these methods. Primary focus was on technique that applied different sections of the body to improve likelihood of identification in a crime scene. All seven reviewed papers reported accurate methods for unknown identification of victim's characteristics and causes of death.

2525 - Modeling the Effects of *Diadema mexicanum* on Benthic Components of Eastern Pacific Coral Reefs

Victor Rodriguez-Ruano

Florida Institute of Technology, Melbourne, FL

Sea urchins of the Diadematidae family have been known for affecting coral reef dynamics such as carbonate balance and macroalgal cover due to their grazing activity. The main objective of this study was to develop statistical models that could describe the response of macroalgae and coral cover to the grazing activity of *Diadema mexicanum* in the Eastern Tropical Pacific (ETP). The study was conducted on the Pacific coast of Panamá, 3 sites were sampled in the Gulf of Chiriquí and 3 others in the Gulf of Panamá using video transects. The relationships between *Diadema mexicanum*, macroalgae cover and coral cover were determined by developing 2 generalized linear models, one for each benthic component. The macroalgae model determined that *D. mexicanum* had a significant negative effect on macroalgae cover while the coral model failed to provide enough evidence for a positive relationship. The model was further tested with data from the Mexican Caribbean, yet if failed to make accurate predictions on the response of macroalgea cover to *Diadema antillarum* density. It was concluded that *D. mexicanum* is likely to play a key role controlling macroalgae population growth, yet the coral relationship might be more influenced by environmental factors such as climate change and El Niño events.

2526 - Investigating the housekeepers of the cell: Molecular chaperones at fertilization.

Altair Dube

Florida Institute of Technology, Melbourne, FL

Proteostasis is a vital component to regulating normal cellular physiology. Molecular chaperones are important in maintaining homeostatic conditions through ensuring proper folding of proteins. We are investigating the changes in protein expression of these molecular chaperones during fertilization, using the starfish *Patiria miniata* as a model system. Although the relative roles of molecular chaperones are well studied in response pathways such as response to stress, roles of chaperones are not well understood during fertilization and early development. The fertilized zygote displays increased metabolism and increased protein synthesis. In this study, the class of molecular chaperones known as heat shock proteins (HSP) were identified and characterized. HSP70 and HSP90 polypeptides, transcripts, and genes were found in the *P. miniata* model using NCBI databases. Then, western blotting and RT-PCR experiments were performed to identify relative protein and mRNA expression levels for both HSP70 and HSP90. The expression of these HSPs significantly changes during the course of fertilization, indicating that they may have important functional roles at sperm and egg fusion.

2534 - Blood Steroid and EDC Metabolite Concentrations in Exposed Mice Plasma

Lawrence Barnoski, Joushua Mogus

East Carolina University, Greenville, NC

Sex steroids are critical for fetal development and sexual differentiation. Disruption of steroid signaling and function during these critical periods can lead to malformation. Humans are exposed to an astounding number of environmental pollutants that disrupt endocrine function. In fact, the rise in reproductive developmental disorders can be linked to these chemicals, collectively known as endocrine disrupting chemicals (EDCs). Vinclozolin, an agricultural fungicide, is a model EDC in rodents used to induce the congenital penis deformity, hypospadias. Hypospadias is a malformation of the male reproductive organs resulting in altered urethral placement. Vinclozolin and its metabolites (M1 and M2) can bind the androgen receptor inducing downstream cascades ultimately masculinizing the genitalia. Although this mechanism is well known, the influence of vinclozolin on hormone concentrations is unknown. Here, we test the hypothesis that vinclozolin alters sex hormone concentrations in both male and female fetuses, and quantify and compare vinclozolin and its metabolite concentrations in both sexes. Pregnant mice were dosed with 125 mg/kg of vinclozolin or corn oil the solvent control. Dam and fetal plasma were collected at embryonic day 16.5. Samples of the mother and embryo blood plasma were collected and analyzed for free and bound steroids as well as metabolites using high-performance liquid chromatography and mass spectroscopy (HPLC-MS). Preliminary results suggest that sex hormones are affected by vinclozolin and that vinclozolin and its metabolites are distributed differently in male and female fetuses. Analysis of blood steroid levels provides a better understanding of the molecular action of EDCs.

2536 - Characterization of NF-κB deficient bone-marrow macrophages

Anthony Peppers, Jeffrey Fischer, Jennifer Bradford

Augusta University, Augusta, GA

The nuclear factor-kappaB (NF-κB) signaling pathway is often aberrantly regulated in many different types of cancers, and many cancers have the hallmark of elevated infiltrating macrophages. To better understand the impact of NF-κB signaling between cancer cells and stromal macrophages, we have developed an animal model that lacks canonical NF-κB

signaling in bone-marrow derived macrophages (BMDMs). The aim of this study was to characterize NF-κB deficient BMDMs that lack canonical (p65 transcription factor) NF-κB signaling. The macrophages for the study were obtained by harvesting the bone-marrow from p65LysMCre (KO) mice and LysMCre control mice. To determine NF-κB deletion efficiency, p65 protein levels were evaluated by fluorescent microscopy in both KO and control BMDMs that had been stimulated with lipopolysaccharide (LPS). To characterize the NF-κB deficient macrophages, the induction of iNOS was monitored in KO and control BMDMs when activated by NF-κB stimulators IFN-γ and LPS. The regulation of iNOS was assessed by comparing macrophages that had been treated with LPS, IFN-γ, or both to a control treatment under fluorescent microscopy. In addition to staining, a nitric oxide assay was employed to help determine the extent of iNOS activity.

2541 - Sea Salt Induced Toxicity and the Protective Effects of L-cysteine in *Xenopus laevis* Embryos

Taylor Pack

Jacksonville State University, Jacksonville, AL

Testing Developmental Toxicants, in Xenopus laevis Embryos, using Sea Salt and L-Cysteine. Taylor Pack, Alaa Qrareya, Kristen Carlisle, Dr. James Rayburn. Concentrations of Sea Salt (NaCl, sodium chloride) in fresh water environments can result in salt induced toxicity. Responses to increased saline vary among species, but can result in reduced survival, delayed development of larvae and embryos, and increased malformations. L-cysteine has been used in numerous experiments to investigate its protective measures on targeted organs in mice or, in this experiment, aquatic organisms. The objectives for this research is to determine if L-cysteine prevents toxicity of salt stress to embryos of Xenopus laevis. The method used for this experiment is The Frog Embryo Teratogenesis Assay – Xenopus (FETAX), a rapid test for identifying developmental toxicants. Due to the sensitivity of embryonic and early life stages, FETAX provides information that may be useful for estimating the chronic toxicity of a test material to aquatic organisms. Xenopus laevis are bred on campus and the eggs are used for testing. FETAX testing is a 96-hour test that uses small cell blastula stage embryos. These embryos are sorted and separated out into 10 per 60 mm petri dish. Embryos are kept in a 24-degree incubator in the dark for 4 days with solutions being changed every day. Dead embryos are removed every 24 hours and recorded. At 96 hours, mortality, malformation, and embryo length are recorded. Stock solutions of sea salt and L-cysteine, in FETAX solutions, are created and diluted to the appropriate concentration. These final concentrations are placed in the treatment dishes with counted embryos in each. Systat statistical analysis software is used to determine if any treatments are significantly different from any other. Using Probit Analysis, an estimated LC50 and EC50 were generated for this experiment for the sea salt concentrations and sea salt + L-cysteine concentrations. The results of this experiment suggest that L-cysteine may not show any significant effect.

2542 - The Effects of Nicotine and Niacin on Chemoreception in the fall armyworm, *Spodoptera frugiperda*: New Strategies for Management

Corey Brooke, Michele Moncrief, Leah Pool, Joanna Gress

Abraham Baldwin Agricultural College, Tifton, GA

The fall armyworm, *Spodoptera frugiperda* (Lepidoptera: Noctuidae), is one of the most detrimental pests of corn and grasses in the Southeastern United States. This pest causes economic losses exceeding $160 million per year. Despite consistent losses resulting from the fall armyworm, many growers are reluctant to use current integrated pest management (IPM) methods for this insect. This can stem from several factors including; heavy infestations are unpredictable, scouting multiple times each summer takes time and skill, and insecticides are

expensive and raise health or environmental concerns. Research towards integrated pest management strategies based on chemoreception has proved promising. Chemoreception is the way an insect perceives its environment and mediates many important pest behaviors including: host plant, mate and oviposition site location. To study the chemoreception response to toxins in the fall armyworms' diet, we conducted a qPCR analysis of *S. frugiperda* caterpillars feeding on an artificial diet. In this study, larvae were fed a diet laced with nicotine and a diet laced with niacin to compare the expression of 18 olfactory- and 5 gustatory-related genes. Nicotine is a potent neurotoxin and is currently utilized in numerous insecticides as a natural combatant to herbivory, whereas niacin is a chemical analog of nicotine found naturally in corn. These results will potentially advance the molecular knowledge of fall armyworm chemoreception and identify candidate genes that may serve as molecular targets for IPM.

2548 - Molecular Barcoding of the *Anopheles crucians* Complex in the Fred Stanback Jr. Ecological Preserve at Catawba College, Salisbury, North Carolina

Elizabeth George

Catawba College, Salisbury, NC

The *Anopheles crucians* complex is composed of seven mosquito species that are cryptic based on morphology due to environmental factors such as temperature, sun exposure and geographic distribution, that may create significant changes in these characteristics. Seven sister species of the complex are currently recognized as *An. bradleyi, An. georgianus* and *An. crucians* A, B, C, D and E. Identification at the species level is crucial as the *An. crucians* complex is a vector for viral diseases such as West Nile Virus and Eastern Equine Encephalitis. To circumvent this difficulty, a molecular assay for the conserved ITS2 gene that exhibits high interspecific and low intraspecific variability was developed by Wilkerson et al. (2004). We therefore hypothesized that application of the ITS2 barcoding assay to collections of *An. crucians* from the Catawba College Fred Stanback Jr. Ecological Preserve (FSJEP) would allow us to not only investigate population shifts over time, but work toward linking species identification via molecular barcoding with morphological characters. Here we discuss standardization of this assay for our laboratory, confirmed complex species in the FSJEP, and the examination of a secondary barcoding assay using 18S ribosomal gene sequence.

2555 - Life History Details of *Procambarus versutus: Ex Situ* Brood Batch Data

Meet Patel, Randall Bassham, Emily Andersen, Kellan Hoffman

Troy University, Troy, AL

Currently, about 97 native species of crayfish are known to occur in Alabama, meanwhile 44 are state listed. Information on life histories for most species is limited, particularly details about fecundity due to the rarity of ovigerous female collections. The objective of this research was to obtain brood size data from ovigerous females of Procambarus versutus, the Sly Crayfish, raised in the laboratory to supplement the lacking fecundity data from a previous life history study. Reproductively active males and females were collected from Beeman Creek in Pike County, Al and were housed in aquaria to allow copulation and egg production at the Environmental Research Laboratory, Troy University. Data were obtained in house from eight ovigerous females, with egg counts ranging from 96 - 216 and a mean of 145. The maternal carapace length varied from 23.39 to 29.21 mm and mean egg diameters varied from 1.73 to 2.26 mm. Maternal carapace length was highly correlated to mean egg diameter ($r = 0.867$, $p = 0.001$); however, there was no significant correlation between the maternal carapace length and brood size. Three additional ovigerous females were observed with dead and/or decomposing eggs; however, data were not collected from these individuals. This study provides new methods that showed to be easily attainable for obtaining data on brood size for crayfish life history studies relative to field collections. Future research should be performed to

determine if our methods are effective in producing data on other species of crayfish to supplement the lacking life history and brood size data.

2558 - Mussel Survivability In-House Simulating Reservoir Drawdown Conditions

Emily Andersen, Lauren Conklin

Troy University, Troy, AL

Little information is available on the tolerances of mussels to desiccated environments, such as severe drought or reservoir drawdown conditions. The drawdown of Point A Reservoir, located near Andalusia, Alabama, prompted a study to determine the effects of the drawdown on the reservoir's mussel community. Two species of mussels, Elliptio pullata and Utterbackia imbecillis, were collected from Point A Reservoir for an in-house study to determine mussel survivability and temperature tolerance in conditions that mimic that of a drained reservoir. A total of 30 mussels from each species were housed in individual beakers containing about 3 cm of sand, and were evenly divided within larger temperature controlled tanks set at 22°C, 28°C, and 33°C to determine the number of days mussels could survive conditions simulating to the drawdown. Mussels were checked for viability every day for the first week and 3 times a week for the remainder of the study until all mussels were dead. At 33°C, U. imbecillis had a mean survival rate of 1.5 d (SD = 0.5, 95% CI [1.2, 1.8]), while E. pullata had a mean survivability of 4 d (SD = 0.8, 95% CI [3.5, 4.5]). Utterbackia imbecillis at 28°C had a mean survivability of 2 d (SD = 0.8, 95% CI [1.5, 2.5]), whereas E. pullata, housed at the same temperature, resulted in a mean survivability of 12 d (SD = 5.9, 95% CI [8.3, 15.7]). At 22°C, the mean survivability of U. imbecillis was 2.5 d (SD = 8.8, 95% CI [14.1, 25.0]), and the mean survivability of E. pullata was 19.6 d (SD = 0.5, 95% CI [2.2, 2.8]). Elliptio pullata showed more resilience to the study conditions than U. imbecillis, and overall survivability increased as the housing temperature approached 22°C. Our study suggested that under in-house conditions mimicking the drawdown, mussels could survive up to 34 days.

2572 - Preliminary Results of the Effect of Apple Snail Egg Protein Extract on African Clawed Frog Embryos

Alexandra Partridge

Jaxksonville State Univerity, Jacksonville, AL

Pomacea canaliculata, commonly known as "apple snails", are an invasive freshwater species predominantly found in temperate regions and subtropical and tropical regions worldwide (Heras, 2006). Apple snails have adapted to deposit their eggs above the waterline in clutches surrounded by a perivitellin fluid that gives it a pink-reddish warning coloration. These eggs contain a toxin of proteinaceous nature that in some cases lead to neurological damage and even fatality (Heras, 2008). The toxicity of the egg extract was studied on *xenopus laevis* embryos because of their short and simple developmental stages. The goal was to test the invasive egg cases potential toxicity levels on the *xenopus laevis* (African clawed frog) using different concentrations of egg extract and FETAX. Groups of ten tadpoles were exposed to different concentrations of egg mass centrifuged for 10 minutes at 1000 RPM and blended with FETAX solution. Each group was incubated and death rates calculated after 24 hours of exposure. Experiments showed 100% fatality in 48-hour old *xenopus laevis* tadpoles at concentrations 50,000 µg/mL and higher. Further studies revealed death rate of 24% on 24-hour old tadpole groups at concentrations low as 62.5 µg/mL. Once a range of survival was found, a set of experiments was used to collect data to show the effects of the apple snail egg extract on the *xenopus laevis* embryos using concentrations 20µg/mL to 5,000µg/mL. Almost all the tadpoles in the control groups, exposed to only FETAX solution, survived. Experimental results supported that the toxicity of the *pomacea canaliculata* is enough to kill *xenopus laevis*

embryos in early developmental stages. These results are preliminary and develop a starting point for subsequent research on the toxicity of apple snail eggs.

2583 - Effect of Nerve Growth Factor on Cardiomyocyte Proliferation after Induction of Hypoxia

Trevond Sellers, Elizabeth Klar, Kathleen Hughes

Columbus State University, Columbus, GA

Myocardial Infarctions (MI), commonly known as a heart attack, is a leading cause of death in the United States with more than 1.5 million cases annually. MIs are caused by blocked arteries which cause damage to cardiomyocytes due to lack of oxygen. Limited research has been conducted on the effects of nerve growth factor (NGF) on proliferation of heart cells after an infarction. This study used rat myoblast cells that were exposed to hypoxia and then treated with NGF as a post treatment. The cultures were incubated at 37°C and exposed to an hour of hypoxia once 80% confluent. After the hypoxia, cells were treated with two different amounts of NGF, 75 ng/ml or 150 ng/ml, and observed at three intervals 6, 12, and 24 hours. Controls were also included: normal cells and 150ng/ml NGF and hypoxia cells with no NGF. Cells were collected at the time intervals and cell viability was determined using trypan blue and a Bio Rad cell counter. The data was not significantly difference across treatments after running a MANOVA. Since the cells showed continued proliferation under the effects of NGF further studies might show if NGF could be an effective treatment following an MI.

2590 - Influence of Nerve Growth Factor Dosing Intervals on Muscular and Functional Regeneration in Mice After Acute Myocardial Injury

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Growth factors have become prominent in a variety of studies for inducing cell survival and proliferation in damaged tissue. Nerve growth factor beta (NGFβ), a neurotrophin, has shown promising results for apoptosis avoidance and angiogenesis in cardiac repair following myocardial infarction. Thus far, the beneficial mechanisms of NGFβ have been attributed to its binding of the tyrosine kinase receptor A (TrkA), which bifurcates into additional pathways contributing to the cellular reactions to either survive or divide. However advantageous the effects of NGFβ might be, there is little research on the appropriate dosing parameters to optimize the activation of the TrkA pathway. Considering previous pharmacokinetic research, we performed an in vivo drug efficacy study on the mammalian heart after infarction. For two weeks, the experimental groups received injections, either NGFβ or saline, every 72 hours. The interval of time between injections, 72 hours, was determined by the time it takes the inflated neurotrophin levels to be returned to baseline levels. Histological analyses assessed cardiac muscle regeneration and ejection fraction from echocardiography measurements were performed to assess functional regeneration. Preliminary results suggest a difference in survival rates between treatments groups.

2595 - Analysis of variation in *Microtus* (Rodentia: Arvicolini) teeth from the Pleistocene Bell Cave deposit of northwestern Alabama

Adriana Smolik

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Bell Cave, Alabama, preserves a multi-fauna Ice Age (Pleistocene) deposit including mammals, birds, herpetofauna, and fishes. Microvertebrate fossils make up the bulk of this material, and include numerous species, including the vole *Microtus* (Rodentia: Arvicolini).

Whereas *Microtus* from Bell Cave has been published previously, the collection of new fossil material warrants revisiting the hypotheses of those studies in light of larger sample sizes. The purpose of this study is to provide a formal description and quantitative analysis of the variation among *Microtus* teeth collected. All teeth were taken from a single site and sorted into zones (1–4) that correlate to the stratigraphic level at which the teeth were found to correct for any morphological changes through time. Teeth were photographed in occlusal view using an AmScope MU 300 digital camera attached to a Nikon SMZ-U Stereoscopic Zoom Microscope and enhanced with Adobe Photoshop CS6. Two-dimensional morphometrics were conducted using MorhoJ. Preliminary results indicate that the first molars show no significant differences, stratigraphically or contralaterally (when right and left specimens were included). Future work will include similarly testing different tooth positions from Zones 3 and 4.

2601 - *Taming of the Brew:* Developing Techniques to Streamline Isolation and Genetic Identification of Wild Yeast Strains from Rowan County, North Carolina

Lee Brackman

Catawba College, Salisbury, NC

Breweries worldwide have been interested in isolating wild yeast, specifically *Saccharomyces* species, to produce novel varieties of beer. The current protocol used in our laboratory (Garcia et. al., 2017, unpublished) to isolate wild yeast strains from their bacterial counterparts follows methods that are time-consuming and variable. Consequently, we sought to develop a more efficient method for yeast isolation. We hypothesized that the application of antibiotics in our selection of axenic yeast strains would result in a quicker isolation process. To determine the optimal antibiotic for method development, we set-up preliminary trials of crude sample with a panel of five antibiotics. Three had the greatest efficacy at eliminating bacterial species while allowing for yeast isolate growth: Chloramphenicol (30 µg/mL), Streptomycin (10 µg/mL), and Ampicillin (10 µg/mL). We next infused yeast growth media (YM) with varying concentrations of Chloramphenicol (30-3000 µg/ml), Streptomycin (10-1000 µg/ml) and Ampicillin (10-1000 µg/ml). Compared with non-antibiotic control YM plates, each antibiotic successfully inhibited bacterial growth while promoting yeast colony growth. Here we discuss the differences in efficiency between the original versus antibiotic-adapted method, the strains subsequently isolated and identified via ITS barcoding analysis, and our suggestions for those interested in taming the wild brew.

2602 - Environmental Mercury in Domestic Cats

Dina Reyes, Joe Poston

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Mercury is a highly toxic element that is released into the atmosphere from human activity such as the burning of fossil fuels. From the atmosphere, the mercury settles on terrestrial and aquatic ecosystems and is incorporated by plants and animals. The purpose of this research project is to determine if domestic cats are exposed to environmental mercury by eating foods that contain mercury, or by eating wild birds or mammals that have mercury within their bodies. We analyzed mercury content in cat food and in fur samples provided by cat owners. The cat owners completed a questionnaire about the diet and housing of their cat(s). The data collection and analysis currently are underway. We will present the latest findings from our project. This research could help cat owners reduce their cat's exposure to mercury by revealing which aspects of a cat's diet and housing are correlated with mercury load.

1622 - Swim Fast and Think Fast: Mobile Trout Make Faster Decisions Than Sedentary Ones

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Randolph-Macon College, Ashland, VA

There is much interest in understanding how suites of interacting traits in a species are affected by natural selection, and traits involving behavior and cognition have received recent attention. One example is the suite of traits involved in cognition and behavior of brook trout (Salvelinus fontinalis). Trout are good candidates for study of cognition and behavior because the selection pressures they face are well-understood: trout aggressively compete for foraging locations with the result that linear dominance hierarchies form that have direct fitness consequences. We asked if a certain behavioral trait (tendency to explore new habitat and hence to be an 'intruder' into an existing dominance hierarchy) was correlated with the cognitive ability to ascertain position within a newly-forming hierarchy. We quantified the tendency to explore using an open-field test on 39 trout, and then introduced each into an existing dominance hierarchy composed of three fish. Behavior of the newcomer and residents was quantified for five hours as the new hierarchy formed. We found three factors most influenced formation of the hierarchy: 1) size of the newcomer relative to the residents (only newcomers at least >10% larger than the residents become dominate), prior residency (when size matched to the residents, newcomers only won 28% of the time), and 'personality' (fish which scored high on the test to measure exploratory tendency made faster decisions about where they were in the hierarchy). These results support the theory that fish with a tendency to explore new habitat also make faster decisions about where they fit in a new dominance hierarchy. We hypothesize that natural selection has resulted in a balanced polymorphism that maintains both exploratory and sedentary behaviors in the same population, and that each behavior is associated with a unique set of cognitive abilities best suited for each lifestyle.

POSTERS

1 - The effect of physiological loading on cortical bone remodeling in white-tailed deer proximal humerus

Jack Nguyen

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Remodeling – the replacement of primary bone with secondary (osteonal) bone was shown to be affected by the type of stress (compression vs. tension) and its magnitude. This study investigated the effect of loading on the morphology and geometry of secondary osteons in the proximal humerus of white-tailed deer. Two cross-sections from the proximal diaphysis of four white-tailed deer humeri were prepared using a low-speed water-cooled diamond saw. One cross-section of each humeri was embedded in an epoxy block and viewed using a scanning electron microscopy (SEM) and the other cross-section was decalcified and viewed with a polarized light microscope. Next, multiple images of each cross-section were captured and then stitched together (PTGUI©) to create a full view of each humerus proximal transverse plane, to determine the areas of bone remodeling. Finally, secondary osteons' geometry and size were measure (ImageJ©) for each humeri in the medial, lateral, cranial and caudal regions. Our results showed that secondary osteons in the cranial region are significantly larger, more angled medially and are less porous (smaller central canal area to osteonal area ratio) than those found in the other three regions. On average, the osteon area in the cranial region is 6369 pixels^2 compared to 4085, 3717, and 4163 pixels^2 in the medial, caudal, and lateral regions respectively. Osteons in the cranial aspect of the humerus are angled on average 105.8º to the frontal plane while osteons in the other three regions are almost perfectly normal to that plane (~90 º). The central canal area to osteonal area ratio is 3.7% for

the cranial region, 4.8% for both the medial and lateral regions and 4.7% for the caudal region. These findings are consistent with previous reports in other bones and species.

2 - Relative Size of the Zygomaticomandibularis Muscle in Frugivorous and Animalivorous Mammals: A Comparative Study of Jaw Adductors in Bats and Carnivorans

Joshua W. Allen, Jillian S. Davis

High Point University, High Point, NC

Mastication is a complex process that involves the use of three dimensional jaw movements to direct precise occlusion between teeth to break down food. Several studies have noted that in mammalian species with a fused mandibular symphysis, late activity of the balancing-side zygomaticomandibularis produces transverse masticatory jaw movement. This is thought to produce transverse lateral bending or "wishboning" forces at the mandibular symphysis, which can be resisted by ossification of this joint. The current study investigates the hypothesis that mammals that have specialized on plant-based diets and have a fused mandibular symphysis will also have a larger, more complex zygomaticomandibularis than their closest animalivorous relatives. In this study, contrast-enhanced microCT scans of representative dietary specialists from orders Chiroptera (bats) and Carnivora (carnivorans) are used to compare size and orientation of the primary jaw adductors, with particular emphasis on the relative size of the compartments of the masseter (including zygomaticomandibularis). We find that within the carnivoran sample, our hypothesis is supported, but within the chiropteran sample, this signal is somewhat more complicated: while the zygomaticomandibularis forms a larger proportion of the masseter in frugivorous species, the masseter itself is much larger in the animalivorous species.

3 - Coupling Kinematic Science with Animation Software: Can Reducing Animated Frames Improve Visualization?

Christian McDermott, Jillian S. Davis

High Point University, High Point, NC

XROMM (X-ray Reconstruction Of Moving Morphology) was developed as a means of providing researchers a precise and minimally invasive way to visualize and quantify the 3D movements that take place in live biological systems during an activity of interest. In XROMM, high-speed x-ray videos are digitized and filtered, digitized data are translated to 3D movements, and these movements are coupled with models of the biological system to create videos in the program Maya (Autodesk), in which the model is precisely keyframed to each frame of the digitized video. In spite of filtration, XROMM animations remain sensitive to "noise" stemming from digitizing error. We hypothesize that because Maya is programmed for producing animations, videos may couple better with the program if Maya is able to interpolate between frames. Thus, in the current study, we investigate whether reducing keyframes in XROMM videos at set intervals can reduce noise while retaining quantitative and visual integrity. Using an existing set of XROMM videos from a carnivoran mastication study (250 FPS), we compare a fully keyframed video with videos in which every fifth and every tenth frame is keyframed. We qualitatively assess whether each video varies in appearance and extract a standard set of 3D measurements to determine whether there are differences in the qualitative accuracy of the altered videos.

4 - Quantification of Mitragynine in Kratom Tea Using High-Performance Liquid Chromatography

Kayla Bonilla, Heather Clontz, Tracy Davis

Wingate University, Wingate, NC

Mitragynine is the most abundant active alkaloid present in the leaves of a Southeast Asian plant named *Mitragyna speciosa*, otherwise known as Kratom. As part of a future mouse study looking at the effects of Kratom on the liver, the optimal conditions for the solubility of Mitragynine from Kratom powder was investigated at various pH and temperature levels by conducting high-performance liquid chromatography (HPLC). Kratom powder was dissolved in solutions consisting of lemon juice and distilled water at various pH values and incubated at different temperatures to determine which solutions would be most suitable for Mitragynine solubility. It was hypothesized that optimal Mitragynine solubility would occur at a more acidic pH at higher temperatures. A standard curve was developed using pure Mitragynine to quantify the amount of Mitragynine in Kratom powder. Using the data from the HPLC, it was determined that the solution producing the highest concentration of Mitragynine was the solution with pH 4 that was incubated at 65°C. This evidence suggests that a solution of lemon juice with pH 4 at 65°C will yield the ideal amount of Mitragynine needed to have impact on the mice in the future studies.

5 - The Effects of Chronic and Binge Ethanol Feeding and Kratom Consumption of Liver Dysfunction in Male Mice

Carsyn Patton, Kinae Ogle, Kayla Bonilla, Tracy Davis

Wingate University, Wingate, NC

Kratom is a product which originates from a Southeast Asian plant that a growing number of people in the United States use to alleviate pain, increase endurance, lower anxiety, and help with opioid withdrawal symptoms. The primary compounds of Kratom, mitragynine and 7-hydroxymitragynine, act as opioids through the μ-receptor. Kratom may offer considerable benefits, but may come with many side effects including hepatic injury. In the present study, C57BL/6 mice were randomly assigned to the following treatment groups: vehicle, ethanol, Kratom, or ethanol + Kratom. After a 5-day acclimation period to a liquid diet, the mice received the treatments for 10 days. On day 11, ethanol was administered to replicate an alcoholic binge. Blood and tissues (liver, heart, and brain) were collected nine hours later and were placed in fixative or frozen for later analyses including histology, real-time PCR, and ELISAs. The degree of liver injury will be assessed by evaluating AST and ALT enzyme levels and occurrence of steatosis. The determination of the effect of mitragynine on liver function will provide pertinent information given the recent deaths associated with Kratom in conjunction with alcohol use. Whether or not liver dysfunction occurs, the results will provide vital information for an area that has little or no data reported. The absence of injury could lend a positive light to the potential of a medically beneficial drug derived from Kratom. The presence of injury may support the speculations of harmful side effects that have been characteristic of recent deaths.

6 - The Effect of Kratom on Fetal Development in Mice

Kinae Ogle, Tracy Davis

Wingate University, Wingate, NC

Kratom comes from a tropical tree called *Mitragyna speciosa*. The leaves from the tropical tree contain mitragynine and 7-hydroxymitragynine, which are active alkaloids that produce psychological and pain relief effects, as well as other opiate-like effects on users. Kratom is commonly used to get a legal high, manage pain, and to treat pain from opioid withdrawal. Users prefer Kratom because it is believed to be a safe option, even though there is a lack of knowledge of long-term use of the opioid on health. In the present study, Kratom was tested on pregnant female mice to determine the impact on fetal development. Kratom was also administrated to female mice to see if anxiety will decrease compared to mice who were not administrated the drug. The solution was prepared by mixing Kratom powder, Tween 80

(Polysorbate 80), and sugar water. The doses used throughout the experiment were 1mg/kg, 3mg/kg, 10mg/kg, and 30mg/kg. Females received Kratom or vehicle beginning day 1 - 18 of pregnancy. An open-field maze was used to test anxiety. The results showed that the pregnant females had fewer pups born compared to the pregnant mice who were not treated. There were no differences on anxiety between the groups. Mitragynine was measured in the Kratom, but was less than the expected concentration. Due to the small sample of mice, more research needs to be conducted to see the impact of Kratom on fetal development.

7 - A Comparative Analysis of Muscle Fiber Characteristics Across Feeding Modes and Breaching Behavior in Shark Species

Ashley DeLeon

UNCW, Wilmington, NC

One reason for the survival of sharks over 400 million years of changing environments is the evolution of their feeding strategies, of which there are three main types: bite feeding, filter feeding, and ram feeding. In addition to variation in feeding modes, some sharks exhibit breaching behavior. In fish, swimming muscles are divided into red (slow, oxidative muscle used for repetitive, long-term activity) and white muscle (fast, anaerobic muscle used for short bursts of activity). My objective was to investigate whether feeding or breaching behavior in sharks would be reflected in differences in the structure of their muscle cells, as these activities require contractions of different forces and durations. Preliminary data suggests that white muscle of a passive filter-feeding basking shark (mean diameter values 235-250 µm) is approximately twice the size of white muscle in an aggressive ram-feeder, the great white shark (mean diameter values 105-138 µm). Both aforementioned species are pelagic and capable of breaching, which is a highly energetic behavior relying on anaerobic metabolic processes. Preliminary data in Atlantic sharpnose sharks, near-shore bite-feeders that do not breach, suggests that within the species the red muscle cell sizes are consistent across different body sizes (TL range 450 mm-886 mm; mean diameter 40-53 µm) while the white muscle values in an immature male shark (TL 450 mm; mean diameter 54-64 µm) were smaller than an adult female (TL 886 mm; mean diameter 130-162 µm) and adult male (TL 839 mm; mean diameter 119-154 µm). Additional muscle samples from the following species will be included: blue sharks (n=16)(pelagic bite-feeders), blacknose sharks (n=4)(near-shore bite-feeders), porbeagle sharks (n=5) and the shortfin mako (n=1)(both pelagic ram-feeders that breach). This information will allow for a better understanding of the evolution of muscle structure in a group of animals with a wide range of feeding techniques.

8 - Annual Cicada Species Response to a Total Solar Eclipse

Caryn Ross

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Documentation as early as 1544 discusses observations of changing animal behavior during a total solar eclipse (Wheeler et al. 1932). The majority of current studies on the subject relate to birds and mammals, few accounting for insects, with only one published study accounting for cicada behavior specifically (Sanborn et al. 1992). In general, species within the *Cicadidae* family are diurnal, however, their song activity varies throughout the time of day depending on species (Sanborn 2000, Shieh et al. 2014). Our study investigates changes in annual cicada singing behavior during the total solar eclipse of August 21, 2017 in the southeastern United States. Audio surveys were conducted at three locations: Columbia, SC, Dunlap, TN, and Ooltewah, TN. Five recordings per day were collected throughout one day prior to the eclipse and on the day of the eclipse. Species singing were identified via sound and spectrogram analysis using Cornell's RavenPro software. To avoid bias, all identifications were done prior to knowledge of species and temporal relationship. Annual cicada species *N. winnemana* and *N.*

linnei that typically sing late in the day were recorded singing earlier as light levels decreased due to the solar eclipse. Species that typically sing mid-day, such as *N. davisi* were present before the event began but absent as light decreased around the eclipse total. The data provides evidence for species specific responses to a solar eclipse, presumably due to the lowered temperature and decreased light. This is the first study to intentionally quantify cicada species response to a total solar eclipse.

9 - Effect of body orientation on vibrational sensitivity of the terrestrial snail *Helix pomatia*

Emma Lavandosky, Eric Bauer

Elon University, Elon, NC

Many animals use vibrations through land and water for a variety of behaviors such as to detect mates, avoid predators, or communicate among each other. Molluscs in general, and terrestrial snails in particular, possess body plans that would seem to confer advantages in detecting surface vibrations, and yet very little research has been conducted on their vibrational sensitivity. A behavioral analysis was conducted to determine the snail *Helix pomatia's* responses to vertical displacement while the animal was in a vertical orientation. Preliminary tests showed such vibrations to be generally aversive to the snails, and our further observations were recorded according to the snails' degree of withdrawal from the delivered stimuli. A withdrawal was recorded if the snail's tentacles, head, or body retracted into the shell during or directly after a 5-second stimulus was presented. Vibrations were presented at three different intensities (6, 8, and 10 mm/s) and seven frequencies (10Hz to 640Hz). The results suggested that the probability of snails' responses increased as the intensity of the vibrational stimuli increased. However, across frequencies, some frequencies tended to elicit more responses, and at lower intensities, than other frequencies. Snails' responses had the highest probabilities for the 40Hz vibrational stimuli. While there was some occurrence of withdrawals to lower frequencies, there were very few withdrawals to any frequencies higher than 40Hz. The orientation of the snails on the vertical post (head-up versus head-down) showed a barely significant difference in their occurrence of responses to the stimuli. Previous research from the lab has shown that 40Hz is also a very sensitive range for snails oriented horizontally, thus putting constraints on the anatomical identity and location of the vibration sensors of the snails. Ultimately, the behavioral sensitivity to frequencies around 40Hz may correlate to the vibrational communications emitted by predators of the *Helix pomatia*.

10 - Atmospheric CO_2 Enrichment and Foraging Preference in the Detritivorous Isopod, *Armadillidium vulgare*

Andrew C. Suddith, Terry D. Richardson

University of North Alabama, Florence, AL

Atmospheric CO2 enrichment may have potential impacts on foraging detritivores, like woodlice, Armadillidium vulgare, by altering the chemical composition of leaf material in detritus-forming plants. Atmospheric CO2 levels have risen from 275-285 ml L-1 to 400 ml L-1 increasing C:N ratios resulting in a lower quality food source for saprophagous isopods such as A. vulgare and altering their preferences. This in turn could affect detritus decomposition, and nutrient and carbon turnover. In this study, the feeding preferences of A. vulgare between naturally senesced Liquidambar styraciflua leaves grown in FACE (free-air CO2 enrichment) and ambient conditions were assessed. Isopods where placed in choice chambers with equal amounts of L. styraciflua leaves grown in both ambient and elevated levels of CO2. FACE leaves had a significantly higher C:N ratio (67.9 ± 2.24 SE) than did ambient grown leaves (59.2 ±1.47). Mass of FACE or ambient leaf matter consumed was measured to estimate feeding preference. Our results indicated no significant difference in feeding choices made between the leaves grown under elevated or ambient CO2 conditions. Due to the fact that

detritivores like A. vulgare already feed on a low quality food source with a relatively high C:N ratio, it may be that any elevated CO2-induced changes in the C:N ratio of the leaves, although significant, will have no effect on foraging preferences. Detrivores may be unable to distinguish between foods with already high C:N rations and those with somewhat elevated C:N ratios from atmospheric CO2 enrichment.

11 - Do Tree Swallows Settle in an Ideal Free Distribution?

Logan Morris, Mark Stanback, Kevin Smith

Davidson College, Davidson, NC

Although Tree Swallows (Tachycineta bicolor) are willing to nest at relatively high densities, they avoid nesting too close to other conspecifics. To test whether these birds would settle in an Ideal Free Distribution, we erected pairs of nest boxes at the Davidson College Lake Campus and two other sites. Box pairs were 40 m apart, boxes within pairs were 10 m apart. We monitored settlement to see if swallows would settle "one nest per box pair" before they were forced to "double up". We found that swallows did not settle randomly but rather avoided near neighbors for as long as possible. Pairs that did "double-up" generally avoided recent settlers but did not choose to nest beside close kin.

12 - The effects of turbidity on mate choice in the guppy *Poecilia reticulata*.

Jenna Hojnacki, Lisa Cantwell

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Turbidity is a growing concern with the use of pesticides that can lead to eutrophication and an increase in quarrying activity that leads to more suspended sediment in the water. Since guppies rely on mostly on vision when choosing a mate, if they are unable to see we would expect there to be a change in their mating behaviors. To test this we examined whether turbidity affects mate choice behavior in the guppy, *Poecilia reticulata*. Specifically, we hypothesized that water turbidity has a negative effect on the precopulatory behavior of the female guppy. Using a no choice design male and female guppies were placed in testing arenas containing either clear or turbid water and the precopulatory behaviors were then observed. We found that both males and females in turbid water took significantly longer to locate the opposite sex compared to those in clear water. However, we found there was no difference in the frequency of precopulatory behaviors in the clear and turbid treatments. The latency finding could be important in regards to the energetic costs and tradeoffs associated with foraging, in addition to the choosiness of the female. If it takes long to find a male, females could forgo trying to find a higher quality male if they are first presented with a lower quality male because of the time and energy needed to forage in addition to finding a mate.

13 - Intraspecific variation in social systems of Artiodactyla and Perissodactyla

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Social organization (group size and composition) and mating system (breeding interactions among individuals) are interrelated components of a social system that influence interactions among animals. These behaviors are often driven by ecological factors and are an important determinant of reproductive success. Recent comparative analyses of mammalian social systems have informed theory on the evolution of social traits. While an important first step to understanding the evolutionary drivers of mammalian social systems, these analyses lacked information on intraspecific variation in social systems (IVSO). Our aims were to determine the

extent of IVSO in ungulates (Orders: Artiodactyla and Perissodactyla) by compiling information gleaned from primary literature and to investigate the potential ecological drivers of IVSO in ungulates. Using *Web of Science* and Google Scholar, we searched the primary literature on ungulates for information on the social organization and mating system, including intraspecific variation within and between populations. For Artiodactyls, we found information on social organization for 44% of species and information on mating systems for 20% of species. For Perissodactyls, we found information on social organization for 63% of species and information on mating systems for 31% of species. Our results highlight the importance of using primary sources of data and considering intraspecific variation in social traits when preparing datasets for comparative analyses.

14 - Vibrational behavioral sensitivity of the terrestrial snail *Helix pomatia*

Ellen Montgomery, Eric Bauer

Elon University, Elon, NC

The use of substrate vibrations, such as pressure waves in the soil or movement of a branch, is widespread among animals for a variety of behaviors and has evolved several times. An initial step towards understanding how organisms use vibrations in their behavioral repertoires is being able to assess how and to what extent they can detect these vibrations. Snails are model organisms for this type of investigation because they have body plans with extensive substrate contact, well-developed nervous systems, and the ability to learn and create memories via classical conditioning. A behavioral assay was performed to determine the snail *Helix pomatia's* aversive responses to varying frequencies (10Hz to 640Hz) and intensities (4mm/s to 10mm/s) of vibrations consisting of vertical displacements of a horizontal surface. Observations were made on the degree of the snails' tentacle withdrawal in response to the vibrations. The salient parameter of the vibration relative to the snail was determined to be velocity, and an initial naïve behavioral tuning curve for the species was created. Additionally, classical conditioning was used to generate a tuning curve better approximating the snails' true range of sensory sensitivity to vibrations. Statistical analysis was performed to determine the probabilities of the snails displaying a strong response or a weak response to each frequency and intensity combination. The results suggested that the snails' maximum sensitivity is around 20Hz, with an upper threshold of 640Hz. Velocity intensities of 4mm/s generated no response at most frequencies until they are paired with an adverse shock stimulus allowing the snails to form a negative association with the vibratory stimulus and making the snails more reliable reporters of their sensory limits. This behavioral sensitivity by *Helix pomatia* may correlate with the vibrational frequencies produced by its predators.

15 - Ectoparasite Induced Behavioral Changes in Harvestmen.

Sarah Burch, Amy Varghese, Virginia Young, Michael Moore

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Parastites have been shown to influence the behavior of their hosts in a number of significant ways. In particular, the presence of ectoparasitic mites on harvestmen (Opiliones) has been shown to influence reproductive and mating success, foraging activity, and competitive abilities. Previous surveys of harvestmen activity in the Ocmulgee National Monument (Macon, GA) suggested that heavier infestations of ectoparasites were correlated with increased daylight activity levels of harvestmen. Such an increase in host activity is may have a positive effect on parasites' dispersal and reproductive success. In this series of studies we investigated if mite ectoparasitism (parasite load) had an effect on activity patterns or reactions to light in *Phalangium opilio*, a species of harvestmen that inhabits floodplain forests within the Ocmulgee National Monument. In lab tests, direct exposure to artificial light sources had no significant effect on multiple behaviors measured. However, in terraria, parasite load

significantly altered the level of activity of hosts during daylight hours over 24 hour intervals. Parasite loads in field-caught harvestmen were generally high, and patterns supported the general inference that higher load is correlated with increased levels of activity. Specific attachment sites and numbers of ectoparasitic mites carried by individual harvestmen are similar to those reported for related harvestmen in North America.

16 - Reaction behavior of the ant species *Nylanderia faisonensis* during sequences of interactions with *Aphaenogaster carolinensis*

J. Thomas Looney, Timothy Menzel

Piedmont College, Demorest, GA

Aphaenogaster carolinensis and *Nylanderia faisonensis* are common ground foraging ant species which co-occur regularly in forests of the southeastern United States. Several student research projects at Piedmont College have investigated interactions between these species. Those projects have identified potential effects of *A. carolinensis* on *N. faisonensis* at the individual and the colony level. These projects mostly involved setting ant baits, consisting of pecan sandy cookie crumbs atop white index cards, and recording video of the behaviors of these species on the bait. Interactions observed between these species sometimes occur in sequences, where an individual *N. faisonensis* might have physical contact with multiple *A. carolinensis* or the same *A.carolinensis* multiple times. This project was undertaken to gain an understanding of how interactions between these species can be affected by interactions that precede them. Sixty of these recordings, along with some new recordings from 2017, were reviewed to determine the change in speed and the change in angle of movement of each species before and after interactions. Analysis was restricted to the first interaction or sequence of interactions in each video to assure the independence of observations. We analyzed thirty-six interactions. Thirty-four out of those thirty-six resulted in an increase in the speed of *N. faisonensis* after interacting with *A. carolinensis*. None of the interactions had a distinguishable effect on *A. carolinensis*' behavior. There was no consistent relationship between change in speed and angle, nor between position in sequence and change in speed or angle. Familiarity with the individual *A. carolinensis* in the interaction also had no consistent effect on the behavior of *N. faisonensis*. *N. faisonensis* appears to be reacting to encounters with *A. carolinensis* without influence from previous interactions.

17 - The Effects of Sex, Kinship, and Neonate Social Environment on Spatial Associations in Pygmy Rattlesnakes

Holly Molinaro[1], Craig Lind[2], Sarah Smiley[1], Terence Farrell[1]

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Recent research indicates that snakes engage in a surprising diversity of social behaviors and that aggregation in snakes is influenced by a variety of factors. We investigated aggregation among young pygmy rattlesnakes, Sistrurus miliarius. We studied 102 pygmy rattlesnakes obtained from 21 litters. Immediately after birth, we placed mothers and their entire litters in outdoor observation enclosures and measured both the closeness of neonate aggregation and the intensity of maternal attention (mean distance between the mother and her offspring) for the next two days. We then isolated the young in individual cages for several days, after which we moved one young snake into another snake's cage to create pairs of snakes that varied in both relatedness (kin versus nonkin) and sex composition (female-female, female-male, and male-male) in a complete factorial experiment. In the following 48 hours we measured pair aggregation as the mean physical distance between snakes. Neither the level of early maternal attentiveness or early neonate aggregation had a significant association with pair aggregation. Similarly, there were no significant main effects of either relatedness or the sex composition of the pairs on aggregation. There was a significant relatedness by sex composition interaction

effect resulting from close association in pairs of unrelated females compared to pairs of unrelated males. Our results are further evidence of social interactions among snakes and indicate the influences of kinship and sex on snake social behavior are not consistent among pitviper species.

18 - Impact of antiepileptic drugs on habituation learning in zebrafish (*Danio rerio*)

Madeline Wetterhall, Linda Niedziela

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Epilepsy is the fourth most common neurological disorder. While seizures can sometimes be prevented by taking antiepileptic drugs (AEDs), many people still suffer from uncontrollable seizures due to ineffective available treatments. Effective treatment of epilepsy relies upon modulating the activity of inhibitory and excitatory receptors, but cognitive deficits are commonly side effects. The GABA receptor is the chief excitatory receptor in immature neurons and has a critical role in developing a neuronal network. Then, a reversal in activity occurs, and the GABA receptor becomes the chief inhibitory receptor in mature neurons. The current study evaluated the effects of exposure to AEDs (valproate, carbamazepine, and gabapentin) during the early developmental time period on cognition (habituation) in zebrafish (*Danio rerio*). Fertilized embryos were placed in 6-well tissue culture plates containing varying concentrations of the three AEDs. DMSO at the solvent concentration was used as a negative control. To assess cognitive deficits, a sound was played to scare zebrafish into a flight response. A decrease in flight response after repeated exposure to the sound indicated habituation. At 5 dpf, a pretest was conducted by playing a 200-Hz sawtooth wave for 1 s, followed by 5 min of silence, for a duration of 20 min. Habituation training was conducted by repeated exposure to the sound for 4 hr. After 16 hr, the posttest was run as the pretest. The number of fish responses was tallied from videos of the pretests and posttests. Per capita habituation indices (HI) were calculated and compared between treatments. Differences were noted between AED type and concentration, but no clear trends were found. Additional studies will be required to further assess the impact of AEDs on cognition.

19 - Social interactions in a maternal colony of big brown bats (*Eptesicus fuscus)*

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This study examines behavior and inter-individual interactions in a maternal colony of big brown bats (*Eptesicus fuscus*) near Asheville NC. A colony roosting in a residential attic was filmed over 3 seasons, from 2012-2014. The birth period occurred in the first week of June each year, and the majority of births were twins. This study compares behavior during the early season (April-May) prior to giving birth, and in the late season (August-September), after the pups had weaned. While analysis is ongoing, we have analyzed 13 videos (15 minutes each) from the early season, and 18 from the later season. In both periods, the colony was least active in the mornings, and overall activity levels increased during the afternoon through the time when the bats departed the roost. Overall activity levels were associated with within-roost temperatures. Initial observations have found that aggressive events (displacement, fighting, and vocal threats) occurred more frequently in the early period when the roost was occupied only by pregnant females. Aggression was observed in 77% of videos in the early season, but only in 22% of videos from the later season. Fights were always preceded by vocal threats or displacement interactions. There appears to have been less total aggression, fewer fights, and a higher incidence of positive interactions (proximity behaviors) in the late season, when the roost was occupied by a mix of females and their recently-weaned young. Colony size was also greater in the late season. These observations suggest that overall levels of aggression

were reduced when young were present in the colony, and may occur less frequently among younger individuals than in adult females alone.

20 - Scaring the silk out of spiders: The use of defensive silk in response to threatening, biological stimuli in the western widow spider (*Latrodectus hesperus*)

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The western widow spider, *Latrodectus hesperus*, is known to modulate its defensive behavior based on perceived level of threat, utilizing more costly and risky behaviors (like biting and venom use) as perceived threat increases. One, little studied, aspect of this defensive behavior is the use of defensive silk. *L. hesperus* produces this silk, which contains large sticky droplets, as they are being threatened and actively tries to place it on the source of the threat. Preliminary evidence suggests that *L. hesperus* can control many aspects of defensive silk use, including the time to initial release, the volume produced, and the rate at which it engages in silk-releasing behavior. In this study, we will further examine the use of defensive silk in *L. hesperus* by examining whether these spiders can perceive threatening, biologically relevant stimuli and modulate their use of defensive silk accordingly. Using a repeated measures design, we will expose these spiders to three different insect species representing different threat levels. These include a specialist spider predator (*Trypoxylon politum*), an opportunistic predator (*Mantis religiosa)*, and a potential prey species (*Acheta domesticus*). We anticipate that the predatory insect species will elicit defensive silk behavior more rapidly than the potential prey species. This research will give us a deeper understanding of how this species recognizes threat and modulates its defensive behaviors, possibly hinting at deeper cognitive abilities.

21 - Preliminary Investigation of Shorebird Diversity and Foraging at Two Beaches in Northeast Florida

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Many migratory and native shorebirds congregate in Northeast Florida, where they forage on local beaches. In recent years, several local beaches have been re-nourished possibly affecting how these birds forage. We investigated the abundance, diversity, and foraging behavior of shorebirds at Guana Tolomato Matanzas National Estuarine Research Reserve (GTMR) and Jacksonville Beach, Florida. We conducted weekly point counts at each location during low tide to measure shorebird abundance and diversity. To determine foraging rates, we measured the number of probes per minute and whether or not they were successful at capturing food. In order to examine how abiotic and biotic factors affect the shorebird communities, we measured sediment size and sampled invertebrates monthly. Preliminary results suggest higher diversity as well as abundance of birds at Jacksonville Beach. We have also noticed differences in foraging behavior. Sediment analysis is ongoing. Overall, we hope to provide insight into the underlying biological and physical components that affect shorebirds, especially in light of local beach re-nourishment regimes.

22 - Effects of Breeding Stage and Behavioral Context on the Singing Behavior of Male Horned Larks (*Eremophila alpestris*)

CareyJo Titus

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Among members of the lark family, Alaudidae, many species are known for their elaborate songs and calls produced in flight. In North America, males of the only lark species, the Horned Lark (*Eremophila alpestris*), have vocal repertoires known to contain two songs, one intermittent and one recitative. Although the general characteristics of these songs have been described, additional study is needed to better understand the functions of these songs in intra- and intersexual communication and how the characteristics of songs and singing behavior might vary during the breeding season. To better understand the use and functions of these songs, I will examine the singing behavior of male Horned Larks throughout an entire breeding season at the Blue Grass Army Depot, Richmond, KY, USA. Focal individuals will be observed and all songs recorded 2 – 3 times per week during observation periods of 30 minutes. The characteristics of songs will subsequently be analyzed and quantified using Raven software (Cornell Lab of Ornithology). Possible variation in use of song types, singing rates, and the characteristics of the songs with breeding stage (pre-pairing, nest-building, egg-laying, incubation, nestling, and post-fledging) and behavioral context (solo singing, singing by one or more neighboring conspecifics, or singing by one or more conspecific males in territories not adjacent to the focal male) will be examined using repeated measures analysis of variance.

23 - Acoustic surveys shed light on the bats found at Eastern Kentucky University

Julia Portmann[1], Luke Dodd[2]

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Bats are ecologically critical insectivores and pollinators. Thus, monitoring their activity across landscapes provides important information. Artificial light sources, such as those found on college campuses, are expected to impact the activity of nocturnal species. Determining the impact of ambient light on bat activity in human-dominated landscapes will provide a baseline for urban bat conservation in the future. To address this research need, bat activity was measured through weekly acoustic surveys (Echometer Touch) at Eastern Kentucky University's campus in Madison County, Kentucky. Eastern Kentucky University's main campus covers 170 ha adjacent to the downtown portion of Richmond (population 35,000). Recordings were processed, and echolocation calls were identified using Bat Call ID v.2.7c. Each acoustic survey began 30 min after sunset, and consisted of ten recording periods lasting three minutes each. The starting location was chosen randomly each survey night, and starting locations were ≥ 100 m from one another. Light intensity was recorded two m above ground, along with other environmental variables (temperature, relative humidity, moon phase, wind) at each survey location. The species most frequently documented over the five weeks were the low-frequency echolocators, *Lasionycteris noctivagans* and *Eptesicus fuscus*, with 78 and 71 passes recorded, respectively. The mid-frequency echolocators, *Lasiurus cinereus*, *L. borealis*, and *Nycticeius humeralis* passes were recorded less frequently, with four passes recorded for each species. All species are well-suited for foraging in open, uncluttered habitats. Analysis indicates a negative correlation between the number of bat passes and time after sunset (r^2 = 0.21 $P < 0.05$), but no correlation was detected between the number of bat passes and light intensity at survey locations ($P = 0.83$). These data suggest that bats at this college campus are habituated to the presence of lights on the landscape, and that foraging habitats are not selected by this environmental condition.

24 - Determinants of Social Behavior in Captive North American River Otters (*Lontra canadensis*).

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Winthrop University, Rock Hill, SC

Field Studies of North American River Otters (Lontra canadensis), documented social behavior atypical among its mustelid relatives. In the wild, river otters are most active during crepuscular hours and males have been shown to be more social than females, as they cooperatively forage within bachelor groups. Most social behavior occurred at latrine sites, where feces acts as a means of communication between conspecifics. While scientists have conducted some behavioral research on wild river otters, detailed studies of interactions are difficult for a species that ranges so widely and spends so much time in the water. Detailed understanding of river otter social patterns requires captive studies, however, as yet few such studies have been done. To help fill this gap we carried out a study of the social behavior of a group of captive river otters. We tested three hypotheses: first, that male otters would engage in more social behavior than females; second, that most social behavior among conspecifics would occur during the early evening; and third, that most social behavior would occur in the terrestrial portion of the exhibit (analogous to latrine sites). Data were collected at the Tennessee Aquarium in Chattanooga, TN, over 8 weeks in June-July 2017. Sex differences were assessed using an ANOVA. We also used an ANOVA to look at how behaviors were distributed by time of day. Location of behavior was assessed with a t Test. Preliminary results indicate that two hypotheses were supported: male river otters were more social than females, and most social behavior occurred during early evening hours. The third hypothesis, that river otters would perform more social behavior in terrestrial parts of the exhibit, was rejected. The frequency of social behaviors in the water was higher than in the terrestrial portion of the exhibit.

26 - Steroid hormone levels as an indicator of personality and aggression in brook trout (*Salvelinus fontinalis)*: A potential animal model for aggression

Emily Ploppert, Massimo Bardi, Charles Gowan

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Dominance hierarchies influence many aspects of animal behavior, and much research has been devoted to investigating if dominant and subordinate animals differ physiologically and, if so, whether these differences are causes or consequences of their differing social positions. In the current study, brook trout (*Salvelinus fontinalis*) were investigated to determine if steroid hormones levels could predict fish behavior in standard laboratory tests of animal personality, as well as the outcome of contests during formation of linear dominance hierarchies. To examine the relationship between personality and steroid hormone levels, blood was drawn before and after fish (n=20) were subjected to three consecutive open field tests (OFT). Pairs of subjects were then size matched introduced to a novel arena where social interactions were recorded over a 2.5 hour period. Testosterone and cortisol levels were measured using Enzyme-Linked Immuno-Sorbent Assays (ELISA). A significant negative relationship was found between cortisol and testosterone. Compared to the baseline levels (averaging 25.5 ng/ml; SE=2.7), cortisol was higher by the end of the third OFT (average=51.3 ng/ml, SE=5.3), and increased even more after the agonistic interactions (average=72.3 ng/ml, SE=6.6). In contrast, testosterone decreased after each test (1st test=24.2 pg/ml, SE=1.7; 2nd test=13.8 pg/ml, SE=2.1; 3rd test=9.3 pg/ml, SE=1.6). No relationship was found between hormone levels and OFT scores or the amount of aggression displayed during agonistic interactions. Using Detrended-Fluctuation Analysis (DFA), the a-values for behavioral time sequences were calculated. The a-values for both aggressive and subordinate behavior showed a significant, but opposite, effect of dominance, thus indicating the dominant fish showed a highly organized sequence of behavioral chains leading to the establishment of dominance. Using a Multi-Dimensional Scaling (MDS) model, we were able discriminate individual dominance very accurately levels (99% corrected allocation), thus confirming that a combination of behavioral and physiological data can reliably predict hierarchical dominance structures.

27 - Mobbing Behavior in Response to Avian or Terrestrial Predators

Cody Hurst, Peter May

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Passerine birds commonly participate in mobbing behavior in order to deter predation. Mobbing is a cooperative effort where birds from multiple species participate. Often, the mobbing call of one bird attracts other birds. Birds mob both snakes and birds of prey. One variable that may affect mobbing response is whether the predator is avian or terrestrial. In this study, a playback of mobbing calls, in conjunction with either a model of an Eastern Screech Owl, Megascops asio, or an Eastern Coral Snake, Micrurus fulvius, was used to instigate mobbing behavior as birds arrived to the area. The predators that these models represent pose two different threats to the birds. Megascops Asio presents a threat to the adults, but Micrurus fulvius, is mobbed because numerous snakes can pose a threat to the birds. To quantify defensive behavior, a model was placed in an area where the predator could normally be found. A recording of mobbing vocalizations was then played for five minutes to attract birds and quantify their behavior. the following data were recorded: the number of individuals present, number of species, time spent mobbing, and how close the birds approached the model. Data analysis showed that only the number of species presenting mobbing behavior showed a significant difference between the two models. The screech owl model attracted an average of 3 different bird species, while the snake model attracted around 6 species ($p=0.000361$).

28 - Testing the Effects Traffic Noise have on Birds within Warner Park

Haley Powell

Lipscomb University, Nashville, TN

Multiple studies suggest traffic has a negative effect on avian life, but not all studies agree on the cause. This study was conducted to see how traffic affected bird counts within Warner Park in Nashville, Tennessee. Data was used from Warner Park's own version of the Breeding Bird Survey. First, each stop's species richness was averaged and compared to the distance that stop was from the road. Of the 19 species studied, each species' trend within the park was compared to its dominant vocal frequency. To more specifically see how traffic noise affected bird trends, we compared traffic to birds whose dominant frequency was below two kilohertz, since that is where most of human noise is generated. Of those 19 birds, there was one with a dominant frequency under two kilohertz, the Yellow-billed Cuckoo. The Eastern Wood-Pewee trend within the park was also compared due to having the same preferred habitat vegetation density as the Yellow-billed Cuckoo and similar negative trend for their entire populations. Their trends were compared to the average of six TDOT traffic stations on roads surrounding the park. Each TDOT traffic station provided an average number of cars that drove by daily for each year. We found that there was no significant correlation between a stop's species richness and its distance from the road. When comparing each species' trend in the park with their dominant song frequency, there was a weak but positive correlation between the two; typically, birds with a lower dominant frequency having a negative trend and birds with higher dominant frequency having a positive trend. There was a negative correlation between the Yellow-billed Cuckoo and the average traffic around the park while the Eastern Wood-Pewee trend remained relatively stable, indicating traffic does influence birds with a lower dominant vocal frequency within Warner Park.

29 - Spectral Characteristics of Harmonics in the B-Call of Hatchling Chinese Blue-breasted Quail (*Coturnix chinensis*).

Edward Mills

Wingate University, Wingate, NC

Hatchling Chinese Blue-breasted Quail (*Coturnix chinensis*) produce a two-syllable B call with two clear harmonics in each syllable. This signal is probably a contact call produced by these precocial birds who may have been separated from their siblings and/or parents. The call's 1st syllable has a fundamental or center frequency (3777 Hz) that is capped by a dual harmonic stack (7627 and 11,422 Hz) of similar length. The 2nd syllable of the B call has a center frequency of 3534 Hz with two similar harmonics at 7101 and 10,662 Hz. These harmonics produced with the main calls at lower amplitudes are essential in providing distance cues to parents and siblings as they degrade over active space. Chick vocalizations were digitally recorded immediately after the hatchlings were removed from the incubator and placed in a brooder. Seven spectral properties of the harmonics were measured to form a baseline of information to examine their relationships to the main calls. These measurements include call length, sound frequencies (Hz) and call decibels (average and maximum power, dB). The results show that the harmonics of both syllables were lower in average and maximum power (dB) than the main calls, and the higher frequency harmonics were produced at lower decibels than the low frequency harmonics; this is consistent with harmonics serving as distance cues for hatchlings.

30 - Unlocking Ancient Carnivore Ecology with Contemporary Feeding Experiments

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A longstanding question in the natural sciences focuses on the paleoecological role of carnivorans in ancient ecosystems. Despite the relative lack of fossilized carnivores, numerous fossil assemblages display evidence of their predation and behavior (e.g., tooth marks, broken bones, carcass deposits). Identifying the carnivores responsible for accumulating these assemblages is a challenging, but essential first step to understanding ancient carnivore-prey interactions. First, we investigate the relative number of fossils attributed to the families Felidae and Bovidae at East Turkana in northern Kenya to determine the proportional representation of these families in a well-documented and researched ancient mammal assemblage (n = 6,688). Second, although previous studies have focused on carnivorans in the wild, we used captive lions (*Panthera leo*) and wolves (*Canis lupis*) at the Chestatee Wildlife Preserve in Dahlonega, Ga to investigate feeding dynamics. The captive carnivorans were allowed to feed on cow (*Bos taurus*) tibia for a period of 24 hours before the bones were analyzed for distinct patterns of bone consumption between taxa. We specifically focused on morphological characteristics analogous to those present in fossil assemblages (e.g., percent consumed, portion consumed, tooth mark length and spatial distribution). We find that although some overlap exists between taxa in these measures, our results indicate that further studies like this one can help to tease apart similarities and differences in the manner by which felids and canids process animal carcasses as well as their ecological role in ancient environments.

31 - Alarm Cue Detection in Embryonic Cuttlefish

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In aquatic systems, alarm cues are waterborne chemicals that alert animals to danger. Cuttlefish and other mollusks release ink when attacked, alerting conspecifics to nearby predators. Ink elicits escape responses in squid and sea hares, providing evidence that it is an alarm cue among mollusks. Embryonic alarm cue detection prepares an animal to respond to salient environmental conditions after hatching. In cuttlefish, the olfactory organ emerges during embryogenesis, allowing for early chemical cue recognition. Despite this, the effects of ink exposure have not been documented in cuttlefish embryos. We hypothesize that embryonic exposure to ink increases escape behavior in cuttlefish hatchlings. A group of cuttlefish eggs will be exposed to conspecific ink, while a separate group will be raised in plain seawater. After hatching, individual cuttlefish from each group will be placed in a choice maze with multiple lanes. An ink stimulus and a plain seawater stimulus will be applied to the lanes. The cuttlefish is free to switch between lanes indefinitely, but stimuli in adjacent lanes do not mix. Movement of the cuttlefish will be recorded in a DanioVision observation chamber. We hypothesize that the ink-treated hatchlings will increase the amount of escape behavior (rapid jetting) in response to the ink stimulus, compared to control hatchlings. Altered behavior is explained by changes within the nervous system. Tubulin and cell body staining will be performed on the olfactory organs of the cuttlefish hatchlings to visualize organization of sensory neurons. Cell body staining allows for quantification of neurons, while tubulin staining reveals axonal processes. We hypothesize that embryonic ink exposure will increase the cell body count as well as the number of axons innervating the olfactory nerve, which terminates in the olfactory lobe of the brain. This work will shed light on the developmental plasticity of behavior in animals.

32 - Climate change and the *Ixodes spp*: Optimal chance for parasite distribution, disease transmission and opportunistic infection

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Both Ixodes pacificus and Ixodes scapularis are parasites that harbor the bacterium Borrelia burgdorferi that transmit Lyme's disease. Evidence of the increase in disease incidence has been observed in several states including Maryland, Pennsylvania, New Jersey and Massachusetts. These are among the 13 states responsible for over 96% of reported cases. At risk individuals include hikers, residents in close proximity to wildlife locations, park employees, and natural resources professionals. Reports indicate that climate change could place Maryland residents at future risk for waterborne and infectious diseases because of increasing temperatures. Concerns regarding climate change on the distribution and frequency I. scapularis in Canada have also been expressed. While the relationship between climate change and the increasing incidence of Lyme's disease in Maryland is central to this study, supportive evidence for this research will be utilized from other areas in the USA. Data from Canadian research will also be employed to provide even broader context of the impending consequences. We reviewed the literature and examined decades of temperature and Lyme's disease incidence data for Maryland, and analyzed for any correlation between studied variables. Our analysis showed that with increased temperature there was also an increase in Lyme's disease incidence. This demonstrated a trend for potential future increase in exposure and subsequently infection rate. In Maryland, where lower annual temperatures were recorded in the 1990's, there was also a lower incidence of Lyme's disease. Monthly and yearly temperatures of ≥5oF starting in the early 2000's also appears to be associated with greater disease incidence. In 2007 – 2008 when the highest temperatures were recorded, incidence of Lyme's was also highest during that decade. The area of climate change, vector, host association and disease spread requires continued research, as better public health and medical interventions become important in averting future health consequences.

33 - The Impact of Crab Pot Distribution on Diamondback Terrapin Presence In the Waters Around Masonboro Island, North Carolina

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Diamondback terrapins (*Malaclemys terrapin*) are a keystone species that inhabits mangroves and salt marshes along the Eastern and Gulf coasts of the United States. Species declines have been attributed to a variety of threats, including habitat loss from coastal development, road mortality, and nest predation. Of particular concern is bycatch in commercial and recreational crab pots that target blue crabs (*Callinectes sapidus*). Incidental bycatch may have direct effects on terrapin populations by reducing numbers and skewing demographic characteristics of populations by specifically removing smaller individuals, such as juveniles and adult males. The North Carolina Coastal Reserve and National Estuarine Research Reserve has initiated a citizen science survey, the Terrapin Tally, to document terrapin presence and abundance in the tidal creeks and bays around Masonboro Island in southeastern North Carolina. Participants paddle designated routes by kayak and document terrapin sightings using a smartphone app. Data collected through the survey may be used to assess trends in terrapin sightings between routes and over time. This study uses kayak survey data to investigate trends in diamondback terrapin sightings and crab pot distribution on two established survey routes around Masonboro Island. We hypothesize that there will be a negative relationship between terrapin sightings and crab pot density. Results will contribute to efforts to identify threats to terrapin populations, and prioritize conservation strategies for this species of concern.

34 - Impact of Natural Disturbance on the Growth and Survival of the Endangered Schweinitz's Sunflower (*Helianthus schweinitzii*)

David Bailey, Kunsiri Grubbs

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The objective of this study was to investigate the impact of vegetative disturbances on the growth of a rare sunflower species of the southeastern United States, Schweinitz's sunflower. Its unique prairie-like habitat has declined due to economic development and environmental degradation. Our hypothesis was that light levels of disturbances stimulate the growth of this sunflower. The investigation involved four sources of disturbance: herbivore damage, competition, soil pollution, and shading. To mimic herbivore damage, the plants were cut and allowed to retain only a few nodes. After six months, the control showed the highest growth and formed the highest amount of lateral shoots. In contrast, the plants with the most damage produced the most lateral stems, which formed from the tuberous rhizome. To examine the effect of competition on growth, grasses were planted along with the sunflowers. The results showed that the growth of the sunflowers was highest in the areas that have 50% grass-coverage, the highest competition treatment. To simulate soil pollution along the roadside, we applied used-motor oil to the soil around the sunflowers once a week. After 6 months, some of the plants treated with the highest concentration (0.75%) were dead, but they later formed lateral stems replacing the original stems that died. To examine the effect of shading on the growth of the sunflower, a shade cloth was placed above them. Though, the plants that were kept under a 70% shading cloth grew the least, they formed the highest amount of flowers. Overall, our results suggest that Schweinitz's sunflower could potentially survive when it is impacted by vegetative disturbances. The severe disturbances cause the sunflowers to form new stems from tuberous rhizomes in order to survive. Of all the tested disturbances, the light was the factor that negatively affected the growth of this sunflower the most.

35 - Determinants of dragonfly community structure at several spatial scales: implications for conservation

Mara Chamlee, Wade Worthen

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Anthropogenic disturbance is a major obstacle to conservation efforts. In the southeastern U.S., urban development and population growth over the past 40 years have transformed the regional forested land-cover to fragmented forested and urbanized areas. Habitat loss and degradation threaten vulnerable lands and species, notably freshwater invertebrate species, which often act as ecological indicators. Odonates are recognized indicators of environmental quality due to the variety of their habitat requirements. We observed patterns of dragonfly diversity and abundance in twelve state, county, and city parks of various sizes and land-cover types, including both urban and forested areas, in wetlands of Greenville County, South Carolina, USA. Two 5m x 50m plots, subdivided into 10 5m x 5m subplots, were established at each aquatic habitat type (stream, river, lake, pond, swamp) at each park. The number of each species in each subplot, and flying through each plot during a 30 minute period, were recorded twice for each plot. The percent cover of vegetation types in subplots was measured and pooled at plot and habitat scales. We used nested ANOVA to assess variation in richness, abundance, and diversity at the site, habitat, plot, and subplot level. Most of the variance in richness and abundance was explained at the plot ($p < 0.0001$ for both variables) and habitat ($p < 0.025$ for both variables) scale. Lakes had more species than streams, and sites with more habitats had more species than sites with one habitat. Differences in vegetation (% cover short woody vegetation) and substrate type (% sand) were found to be significant but less important in Akeike models. Thus, we conclude that the best plan for augmenting dragonfly diversity is increasing habitat type rather than manipulating habitat structure.

36 - The Effect of Competition and Light on the Growth and Survival of American Chestnut Hybrid Seedlings in Southern Appalachian Cove Forests

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The American Chestnut (*Castanea denata*) was once a dominant hardwood species on the east coast of the United States. In the last 100 years an invasive parasitic fungus known as blight (*Cryphonectria parasitica*) decimated the chestnut population. Although the scientific community is close to creating a blight resistant American Chestnut hybrid, the successful reintroduction of the chestnut depends on the ecological niche it occupies in the modern temperate forest. This study is an ongoing experiment involving Restoration Chestnut 1.0 saplings on eight plots in West Virginia. The data represents year three of an ongoing five year study. The experiment had three variables; small (40% light) and large (60% light) gaps, landscape fabric (with and without), and application of 12" tree shelters (with and without). Gap size accounted for varying light level percentage, landscape allowed for competition variance, and tree shelters prevented girdling by rodents. On every plot 7' deer fences were erected. It was predicted that chestnut seedlings would grow and survive significantly better in small gaps, with both landscape fabric and tree shelter treatment. Height and diameter were significantly greater in small gaps (p-value <0.03, p-value <0.001). Diameter was also significantly greater with landscape fabric (p-value <0.005). An interaction effect showed that chestnuts planted in large gaps performed just as well as in small gaps as long as there was landscape fabric. Survival was significantly greater in small gaps (78.5%) than in large (53.0%) (p-value <0.003). In conclusion, we recommend planting chestnuts in small gaps in southern Appalachian cove forests given greater growth and survival and less initial investment.

37 - Single nucleotide polymorphism (SNP) analysis of *Symphyotrichum georgianum* from large and small Georgia, South Carolina, and North Carolina populations.

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The Citadel, Charleston, SC

Symphyotrichum georgianum (Alexander) G.L. Nesom (Georgia aster) is a perennial rhizomatous obligate outcrossing Aster endemic to the southeastern United States, occurring mostly in Piedmont habitats. Once listed as a candidate species for protection under the Endangered Species Act, this species is now managed under a Candidate Conservation Agreement between the USFWS and other partners. Previous genetic research found that large populations in Georgia and North Carolina were more genetically diverse than the small populations and the small populations were more genetically diverse than the large populations in Alabama and South Carolina. It is possible that these low genetic diversity estimates in large Alabama and South Carolina populations are the result of extensive clonal growth producing many stems of few individual genotypes. In this current study, we use 22 single nucleotide polymorphism (SNP) loci to genotype individual plants in large and small Georgia, South Carolina and North Carolina populations. Individual plants were georeferenced, allowing us to assess within site fine-scale genetic structure. Of the 320 individual plants genotyped, we identified 308 unique multilocus genotypes, 11 clones were represented by two individual plants, and one clone represented by three plants sampled from a small Georgia population. Significant fine-scale genetic structure was observed in 5 small and 2 large populations tested, while large-scale genetic relationships reflect geographic proximity. Approximately half of the sites in this study showed significant within site genetic structure, although we found no evidence of extensive clonal growth. Reintroduction of fire and opening the canopy has been shown to stimulate Georgia aster flowering. Encouraging sexual reproduction through best management practices could increase Georgia aster sexual reproduction, genetic diversity, and the long-term population viability of these populations.

38 - Genetic Origin of *Sarracenia* Hybrids from Western North Carolina

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The *Sarracenia* (pitcher plant) genus, a group of carnivorous herbs, includes many species of conservation concern. S*arracenia* species hybridize when in sympatry, with seemingly few pre-zygotic barriers to cross-fertilization. Two pitcher plant species, *S. jonesii* and *S. purpurea* var *montana*, are native to western North Carolina bogs, and others, including *S. flava* and *S. leucophylla*, have been introduced to the region. In this study, we examined the genetic composition of phenotypically hybrid plants from a site in which these four species co-occur. Plants were non-destructively sampled, with tissue cut from leaf keels, and modified Qiagen kits were used to extract whole genomic DNA. Six published microsatellite loci, known to distinguish among *Sarracenia* species, were PCR-amplified; fragment lengths were quantified in Geneious. As one locus revealed ambiguous results, it was not considered in further analyses. Calculations of hybrid indices showed that all individuals contained *S. jonesii* and *S. purpurea* var *montana* DNA, and that the *S. jonesii* lineage of hybrid plants ranged from 20 - 60%. The latter result is of particular concern, as *S. jonesii* is being considered for federal listing. Ongoing experiments are investigating genetic diversity within and among *S. jonesii* and *S. purpurea* var *montana* sites in western North Carolina, to better understand population dynamics and prioritize conservation work.

39 - Evaluating current species boundaries between *Liatris helleri* and *Liatris turgida* using high-resolution microsatellite markers

Logan Clark, Matt Estep

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Liatris helleri Porter (Asteraceae), Heller's Blazing Star, is a rare perennial herb found on rocky faces and summits in western North Carolina. *L. helleri* is federally threatened and, as currently defined, includes only nine populations. *Liatris helleri* is closely related to *Liatris turgida* Gaiser, Shale Barren Blazing Star, a lower elevation species with similar morphology and habitat requirements. The separation of these two taxa as individual species has been historically contentious with the most recent morphological analysis suggesting "together" they represent a single species (Nesom, 2005b). If *L. helleri* is re-circumscribed more broadly to include those populations currently described as *L. turgida*, then the federal status of *L. helleri* (senso lato) will require re-evaluation and will likely not meet the standards for federal protection under the Endangered Species Act. We aim to develop a minimum of 16 high-resolution microsatellite markers to use in a population genetic study of the species across its range and sympatric areas with *L. turgida*. Development of microsatellite markers will allow us to investigate the species boundaries between these taxa to confirm or deny the need to re-circumscribe this imperiled species.

40 - Assembling a molecular toolkit for *Geum geniculatum* Michx.

Marietta Shattelroe, Matt Estep

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Geum geniculatum Michx., bent avens, is an endemic, perennial herb occurring at high elevations on three mountain peaks in the southern Appalachians. The cool, moist climate of the high elevations of the Southern Appalachians are thought to of acted as a refugia for a community of plants including this species during the climatic warming post-Pleistocene. While geographically restricted, these herbs are often locally abundant occurring in up to thousands of individuals per population. Biological research is lacking for G. geniculatum therefore understanding simple life history traits, population demography, pollination biology and genetic diversity are needed to inform conservation strategies for the species. A pilot study was conducted to determine if microsatellite markers constructed for Geum urbanum or Geum reptans would cross amplify in G. geniculatum. Twenty-one markers were screened across individuals from one population in Western North Carolina. Eighteen (86%) of the markers amplified across all individuals screened and were further genotyped to measure allelic diversity and heterozygosity. During the summer of 2018, all known populations will be demographically surveyed and leaf tissue samples will be collected for DNA extraction. The 18 microsatellite markers will be used to genotype these populations to determine genetic diversity and population connectivity.

41 - Investigating the ecology and habitat modeling of Solanum conocarpum on St. John, USVI

Cecilia Rogers, Heather Griscom

James Madison University, Harrisonburg, VA

Over the last three hundred years, Caribbean islands have had chronic disturbance from tourism and development. The biodiversity of these fragile ecosystems, many of which are endemic, have been negatively affected by habitat degradation, deforestation, and introduction of exotic species. One species that may become extinct due to this degradation is *Solanum conocarpum. Solanum conocarpum* (marron bacora) is a rare shrub, endemic to the dry tropical forests of St. John, USVI. This plant is a species of conservation concern and is one of

very few native and endemic plant species on St. John. Very little is known about the ecology and reproduction of *S. conocarpum*. Two populations with > 10 individuals are found at two sites on the southeastern side of the island. Four other populations have less than 10 individuals. The species are not regenerating successfully and the barrier(s) are unknown. This study investigated the ecology and habitat of *S. conocarpum* in order to construct a habitat model and determine potential causes for low reproduction. All individuals within each population at 5 different sites were measured for height, basal area, as well as absence or presence of flowers and fruit. Site had no significant effect on plant growth and reproduction. All populations were reproducing (16%-100% of the individuals). Population size was noticeably greater at one site than all others (N=104 vs. N<15). The largest population had shortest distance to the shoreline (30m), low elevation (40m), and flat terrain. However, the catastrophic Irma hurricane devastated this large population suggesting that reintroduction close to the shore is unlikely to be successful due increasing hurricane intensity and frequency with climate change. Future conservation efforts should target reintroduction at sites 200 to 430 meters from the shoreline and at an elevation of 100-200 meters.

42 - Comparing nutrient uptake efficiency of Nitrogen and Carbon in Hydroponics and Soil grown *Phaseolus vulgaris* (Blue Lake Bush Beans)

Joe Schosky

Furman University, Greenville, SC

Many research studies evaluate nitrogen use efficiency of plants in soil base agriculture but is a lack of research examining nitrogen use efficiency of plants in hydroponic systems. In order to compare nitrogen use efficiency between soil based agriculture and hydroponics, a nutrient film technique hydroponic system was built to grow Blue Lake Bush Beans (*Phaseolus vulgaris* L.) for this experiment. Bean seedlings were first planted for germination in soil. Seedlings were simultaneously transferred to outdoor soil plots or the hydroponic system both located beside the Bell Greenhouse at Furman University, Greenville, SC. The plants were grown for 30 days before being harvested. Daily measurements on plant height were recorded for each system. Upon harvesting of the plants, they were dried and tested for nitrogen and carbon levels. Results indicated that beans grown hydroponically contain a higher concentration of nitrogen but a lower carbon yield compared to soil-grown plants. This has implications for nitrogen use by agricultural plants.

43 - Water Usage In Hydroponic and Soil Based Agriculture

Michael Sharpe

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Phaseolus vulgaris (Blue Lake Bush Bean) plants were grown in hydroponic systems and the also soil plots to determine the water use of each method of cultivation. Plants were started in plastic flats and transplanted into either the hydroponic or soil plots at the same time. Both sets of plants were measured daily to determine growth rates. Hydroponic systems exhibited higher rates of growth throughout the duration of the experiment. The soil raised plants were also healthy, one plot was much more successful than the other. The healthy soil plot exhibited plants that were as proficient as those plants in the hydroponic system. The hydroponic plants had some trouble with the heat but this was due to the area they were placed in rather than anything to do with the parameters of the experiment. After the plants had reached maturity they were removed from both the hydroponic systems and the soil plots. The plants were then weighed to determine fresh weight productivity. Water usage in both systems were recorded. The hydroponic system water usage was recorded via a daily chart of how much water was added to the reservoirs. Soil system water usage was recorded from a weather monitoring station that included a rain bucket. The times the soil plots were watered via a sprinkler system

were recorded as well. The plant weight was compared to the amount of water that was used in each scenario. The plants that used the least amount of water to produce the highest amount of dry matter were considered the most efficient. The hydroponic plants appear to be more water efficient as their dry matter production was much higher than the soil system plants on average.

44 - Relationships between European Honey Bee Health and Foraging Preferences on a University Campus

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The European Honey Bee is an important species widely utilized in the agriculture industry in order to maintain floral diversity. They are sensitive indicators of pesticide use, disease susceptibility, and human impact. This study aims to understand how foraging preferences promote good bee hive health and what tools are most effective in the maintenance of an apiary. The primary focus of this research was to study how differing landscapes around a university campus and adjacent agricultural fields affected hive production and health. Data collection sheets were designed to record periodic hive inspections. Throughout the course of a year, the hives were routinely inspected for honey stores, egg production, population, and pests. On a seasonal basis, pollen from bee leg loads was collected from the most productive hive in order to identify the various flora visited. Analyzing the bee's preferred flora will aid in making recommendations for mitigating pesticide and herbicide use on university property, ultimately maintaining the honey bee's health. With the combined understanding of the hive structure, overall health, and bee food sources, this research could be applied to apiaries across the US, including university campuses, supporting bee populations and bee health.

45 - Pollinators of Blue Ridge Parkway: A Citizen Science monitoring project

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The Blue Ridge Parkway (BRPW) is the longest linear park in the US, comprising almost 500 miles of roadway in the states of Virginia and North Carolina. At its establishment, multiple bays along the Parkway were designated as "Wildflower Viewing Areas" intended to preserve and educate visitors about the native flora of the region, but the bays were never completed. Interest in establishing these viewing areas has re-awakened, motivated by the growing awareness that human-mediated habitat loss has likely played a role in declines in important species groups, such as pollinators, and the services they provide to ecosystems. The new proposal for the Wildflower Areas specifies that they be designed as pollinator food habitat. Arguments for investment in these expensive Viewing Areas would be greatly supported by description of the pollinators present; however, data on the current state of pollinator population in the region is severely lacking. Here we describe a Citizen Science inventory that aims to quantify pollinator abundance and diversity along the BRPW prior to the establishment of the planned Wildflower Viewing Areas. A preliminary study showed that netting alone was not sufficient for capturing rare species, thus we will survey pollinators using netting, glycol traps, and targeted observations of rare plants. We predict that these surveying techniques should lead to better assessment of the range of pollinator taxa actually present, including abundant species and the elusive, rarely observed specialists. Having a quality baseline dataset will allow for assessment of pre-post treatment effects of the Wildflower Viewing Areas, specifically indicating whether converting grassy bays to increase pollinator food resources is a worthwhile investment of scarce financial resources for the BRPW.

46 - Comparing nutrients and quality of aeroponically grown lettuce versus lettuce purchased from a grocery store.

Matthew Miller, Joshua Ganezer, R. Matthew Cudd, Danny Gustafson, Jennifer Albert

The Citadel, Charleston, SC

Food production using ecologically sustainable methods has the potential of providing high-quality, fresh food without depleting our natural resources. Advances in container grown plant products could provide fresh food for deployed military troops, areas devastated by natural disasters, and food deserts in urban settings. The Citadel's Sustainability Project is using a modified 8 x 40 ft. refrigerated shipping container to grow a variety of leafy crops and herbs utilizing a customized, automated aeroponics farming system. This aeroponic system consists of 14 double-sided vertical panels, each capable of growing 330 plants. Water, which is automatically dosed with nutrients based on conductivity and pH readings, is misted through the root system, then reclaimed and recycled. Aeroponic farming has several benefits compared to traditional farming by using less water, fewer carbon emissions, and reduced need for pesticide and herbicides. In this study, we tested for differences in plant tissue nutrient levels of lettuce grown aeroponically on campus versus lettuce purchased from a local grocery store. Aeroponically grown plants had equal (N, S, Zn) or greater nutrient (P, K, Ca, Mg, Cu, Mn, Fe, Na) levels than the purchased lettuce. Three people assessed the lettuce quality using the United States Department of Agriculture's U.S. Grade Standards. All five purchased lettuce heads graded lower because of mechanical damage and bruising, while the container grown were considerably smaller than purchased lettuce. Based on visual inspection and grading standards criteria, two-thirds of the people preferred the fresh aeroponic lettuce over purchased plants. This study will be repeated in the spring of 2018 to assess nutrient levels, quality, and consistency in producing quality lettuce aeroponically relative to lettuce purchased locally.

47 - Effects of habitat and coyote (*Canis latrans*) presence on site occupancy by white-tailed deer (*Odocoileus virginianus*) and feral cats (*Felis catus*)

Jonathan Storm, Lindsay Arthur, Jessica Cuadra, Briget Doyle, Kirstie Mundok

University of South Carolina Upstate, Spartanburg, SC

Coyotes (Canis latrans) are a highly adaptable species that have recently expanded their range into the southeastern United States. Although they are primarily a predator of rabbits and mice, it is possible that coyotes may also reduce populations of white-tail deer (Odocoileus virginianus) and feral cats (Felis catus). In this study, we sought to determine whether coyote presence reduced site occupancy by white-tail deer and feral or domestic cats. During 2011-2017, we placed wildlife cameras within 20 rural forests and 19 urban greenways in Spartanburg County, SC. We used ArcGIS to categorize the habitat within a 1 km radius of each camera to determine whether habitat type influenced site occupancy by each species. We found that coyote presence did not have a significant effect on the occupancy status of either white-tail deer or feral cats. We detected coyotes at 63% of our study sites and none of the habitat variables had a significant effect on site occupancy by coyotes. For white-tail deer, there was a trend for occupancy status to increase as the amount of forested habitat increased around the site, but this effect was not statistically significant. We also found that feral cats were significantly more likely to occupy sites in residential and commercial areas that had reduced forest cover. Our results suggest that coyotes are a habitat generalist in Upstate South Carolina and they do not influence the distribution of white-tail deer or feral cats.

48 - Agent based modeling of the dilution effect of diversity in the Lyme disease system

Tessa Jones, Kevin Smith

Davidson College, Davidson, NC

Lyme disease, caused by the bacterium *Borrelia burgdorferi* , is an emerging infectious disease spread by black-legged ticks in much of eastern North America. Lyme disease affects over 300,000 individuals in the United States alone each year, with a trend toward increases in the number of cases of geographic range of cases. Models of Lyme disease transmission between multiple wildlife host species and the tick vector have led to an improved understanding of the roles played by biodiversity, habitat modification, and biodiversity change in the risk of Lyme disease for humans. Previous models have focused on the importance of species diversity and variation in host abundance and competence to define the dilution effect of biodiversity, where locations with more potential host species have lower Lyme disease levels than those with fewer host species. Our agent based model, constructed in NetLogo, builds upon these previous models by adding biological realism in the form of multiple tick life cycle stages included in the model. We also reduce the number of assumptions by introducing the probability of contact between ticks and hosts, which itself can be a function of habitat or host movement. The use of an agent-based model has the potential to improve the accuracy of Lyme disease transmission rate indicators such as nymphal infection prevalence and the density of infected nymphs within a habitat or region. The model will be used to gain a better understanding of the impact of host to host contact by exploring homing ranges and species-specific grouping. These investigations will improve our understanding of Lyme disease transmission and potentially help reduce the number of humans infected each year.

49 - Habitat Use by Waterfowl on Former Surface Mines and Natural Wetlands in the Virginia Coalfields

Kyle Hill, Walter Smith

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The heart of the Appalachian Mountains in southwest Virginia is a well-known hotspot of biodiversity for several taxonomic groups, including freshwater mussels and amphibians, among others. While much of this region's aquatic biodiversity has been heavily studied, less is known about taxa that rely on this region for overwintering and/or as stopping points along migratory pathways. In particular, migratory waterfowl use this area's beaver ponds, riparian wetlands, and constructed ponds on former surface mines as habitat. To date, however, little to no knowledge of the waterfowl species which utilize these areas for both breeding and migration exists. We performed ground-based point surveys using both field visits and game cameras at various ponds and wetlands across the southwest Virginia coalfields to confirm waterfowl species presence, comparing habitat use across natural wetlands and those artificially constructed on former surface mines. A total of 18 species have been recorded to date across three wetland complexes in the Virginia coalfield region. While some taxa appear to prefer natural wetlands, others have been found using both natural and artificial wetlands repeatedly during seasonal migrations across several years of study. These results suggest that high-elevation, surface mine-associated wetlands present a potentially substantial amount of available habitat across the Appalachian coalfields. Future work should investigate the nature of habitat use in these wetlands to better understand waterfowl ecology in this region.

50 - GIS Mapping and Habitat Delineation of the Tater Hill Fen (Bog)

Mary Butler Fleming, Matt Estep

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The successional dynamics of Southern Appalachian fens remain a mystery to the scientific community. This rare occurring transitional habitat is home to many rare or endangered plants, such as Gray's Lilly, (*Lilium grayi*), and American fly-honeysuckle (*Lonicera canadensis*). The Tater Hill Plant Preserve in Watauga county NC (just north of Boone) provides an opportunity to study the successional dynamics. To measure and record the successional dynamics occurring within the boundaries of the fen, a handheld GPS is used to record a variety of tracks within the area, representing water line, open canopy, shrub layer, and finally closed canopy forest. Combining these tracks with water quality data from the NC Department of Environmental Quality's groundwater monitoring system located within the fen will allow us to examine fluid changes between terrestrial and aquatic habitats that can be modeled digitally over time. The presence of beavers (*Castor canadensis*) has been noted, dens have been located along with respective territories. Through meeting their basic needs of shelter and food, beavers are morphing the fen on Tater Hill. Evidence of habitat change has been observed through recording changes in territory size, den locations, water flow and relative water depth. Subsequent changes of flooding by beavers have decreased canopy cover, increased the amount of flooded land, and has allowed formation of new terrestrial habitats through the increase of sphagnum moss beds. The digital model will allow us to predict the future species ranges resulting from water flow dynamics, as well as aiding in conservation and protection of the rare plants occurring within the fen.

51 - Spatial distribution of terrestrial microplastic pollution: modeling debris abundance and distribution in Columbia County, Arkansas

Catherine Sanchez, Kate Sheehan

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Plastic debris can be fatal to wildlife in many circumstances, and it can also have sub-lethal effects on organisms that consume it. Microplastic pollution is well documented in marine food webs, apparently consumed by planktonic organisms, seabirds, and even whales. However, microplastic pollution is not well documented in terrestrial food webs. Because plastic debris can impact wildlife populations, it is important to understand its distribution and abundance to devise methods for pollution reduction and remediation. In this study, we sampled for plastic debris in drainage ditches along roadsides in southwestern Arkansas to determine what factors influence its distribution and abundance. We collected triplicate sediment core samples from 21 sites within a 14.5 km radius of Southern Arkansas University. Using geospatial statistical software (ArcMap Pro), we estimate the distribution and abundance of microplastic debris in sediments using interpolation techniques. To inform our models, we include information associated with local transportation data (type of road and speed limit), topological information (distance of the ditch from the road and the presence of vegetation and/or animals), and census data (business, residential, or rural classification, adjacent land cover type, and human populations nearby). Our preliminary findings suggest that microplastics along roadsides in Columbia County, Arkansas can exceed 7,000 pieces of microplastic per square meter, with the mean number of plastics occurring at densities closer to 2,000 pieces per square meter. Thus, we confirm that, in addition to marine environments, microplastics occur in terrestrial soils. Like in marine systems, plastics have the potential to enter into terrestrial food webs, and ultimately impact local human populations. While the sources of terrestrial microplastic accumulations is speculative, we suspect the incidence of plastic ingestion could be reduced through increased anti-litter education campaigns, more frequent roadside-cleanup initiatives, and more thoughtful municipal mowing activities.

52 - Beech Bark Disease spread at Elk Knob State Park, NC

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We report efforts to map the southward spread of Beech Bark Disease (BBD) in Elk Knob State Park, North Carolina. This area of study lies on the encroachment front of BBD, yet it is unclear what the boundaries of the BBD infestation are, or whether a secondary infestation is occurring. The tell signs of this invasive disease are constituted by a woolly substance excreted by an initial scale insect, *Xylococculus betulae*. Post-feeding pores left by the Beech scale allow *Neonectria faginata* and *N. ditissima* to invade and attack the tree's cambium. Once invaded, both species of *Neonectria* produce definitive orange-red fruiting bodies for future spore dispersal. Through the use of these two visible markers, we have geolocated individually infected trees, with a primary emphasis on individuals displaying fruiting bodies. Extensive surveys were carried out in 2016 to assess the distribution of BBD across Elk Knob, and BBD occurrence was universally low in sampled plots. Here we report the results of resurveying efforts undertaken in 2017/2018 that show the expansion of BBD symptoms at Elk Knob. Maps of BBD spread will be used to estimate range expansion for BBD, as well as enable future canopy sample efforts to determine secondary chemistry responses to BBD infestation.

53 - Changes in spatial distribution of Southeastern salamanders in the Blue Ridge region with respect to future climate change scenarios

Emily Anderson, John Quinn

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The Blue Ridge region of the Southeastern United States supports high diversity of amphibians, especially salamanders. These salamanders are highly susceptible to environmental changes induced or augmented by anthropogenic climate change. Thus, data are needed to predict expected changes in salamander occupancy. Environmental variability, including temperature, could affect breeding and migration habits. Many species of amphibians breed in highly specific areas, moving annually to generationally utilized breeding and offspring rearing sites. Precipitation and temperature changes present potential threats to the time and presence of theses specific environmental conditions. Irregular rainfall and droughts threaten to create a vacuum of breeding sites. Accurate predictions of future changes will provide information for the adequate proactive preservation of habitat to ensure species persistence. We used species distribution modeling to visualize salamander occupancy across the Blue Ridge region. We used the resulting maps to determine range under climate scenarios.We intend to process additional species, including Notophthalmus viridescens and Eurycea guttolineata in future tests. Of 115 occurences of Ambystoma tigrinum in the Southeast, approximately 98 occurrences were in regions expected to experience a temperature increase of at least 4 degrees Celsius. Changes in species ranges, beyond protected areas, challenge traditional conservation options. Significant movement outside of protected areas would require proactive community engagement and education in areas to which the species would migrate. The presence of amphibians is highly indicative of habitat quality, thus they are referred to as indicator species. Such indicator species can be used to measure the health of waterways and ecosystems. More broadly, changes in range could elevate conservation status on IUCN and Endangered Species listings to a more vulnerable status.

54 - Using Geographic Information Systems to Construct a Predictive Model for the Occurrence of Invasive Plant Species in Northeast Georgia

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Piedmont College, Demorest, GA

Students in an advanced Geographic Information Systems (GIS) course at Piedmont College were tasked with producing a predictive model for invasive plant species occurrence with data available from the Chattahoochee-Oconee National Forest Supervisor's Office. Data received

included documented areas of invasive plant occurrence (elemental occurrences), LiDAR based rasters for elevation, slope, and aspect, and rasters for eco-zone and Weiss classifications. Individual layers for each documented elemental occurrence were generated and each raster was clipped to these occurrences. Statistics from the clipped rasters were used to produce models assigning probabilities of invasive occurrence to all the pixels in the region for each of the variables. Then, the probability maps that were generated were summed to produce a final probability map including all variables. Follow-up field work this spring will evaluate the success of the model in predicting actual invasive occurrence.

55 - The Margays of Wildsumaco

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Margays *Lepardus wiedii* are small, elusive cats found in the neotropics. Like many wild felids, margays are on the decline and listed as a Near Threatened species by the International Union for Conservation of Nature (IUCN). We began a pilot camera trap study in 2008 at Wildsumaco Wildlife Sanctuary (WWS) in the eastern Andean foothills of Ecuador. The margay was one of our most frequent captures and has become a flagship species for the sanctuary and the Wildsumaco Biological Station. Our data indicate that Wildsumaco may have some of the highest densities of margays in the Neotropics. However, since 2011 we had not surveyed the margay population. We are currently in the process of implementing a new margay conservation program and recently redeployed cameras to assess the status of the margay population. We captured over 50 margay images and identified at least ten individuals, including a male and female from the original study. Our long-term goals include the establishment of a permanent camera-trapping grid to gather population data on margays at WWS (number, sex, age, reproduction, turnover) as well as investigate the "ocelot effect", the role that incoming ocelots may play in the depression of margay numbers. We hope to use this information to create a long-term conservation plan for the declining and Near Threatened margay.

56 - The relationship between ovenbird (*Seiurus aurocapilla*) territory location and topography at the Lillian E. Smith Center, Rabun County, Georgia

Timothy Menzel, Mckenzie Latta

Piedmont College, Demorest, GA

Understanding characteristics of breeding habitat is critical for conservation of a wide array of species. The Ovenbird is a warbler that breeds on uplands and slopes in montane landscapes. Studies of Ovenbird breeding have focused on measures of habitat quality taken in the field. The purpose of this study was to identify important topographical features, which can be quantified from available Light Detection and Ranging (LiDAR) imagery. Ovenbird territories at the Lillian E. Smith Center (LES) were located by listening for singing males in the summer of 2017. The Lillian E. Smith (LES) Center is a 150-acre forested landscape located in Rabun County, Georgia. Locations of eleven singing-male Ovenbirds were visited repeatedly, and coordinates of an estimated center for each location were determined. We created a 50 m buffer around each location and clipped LiDAR-based rasters for elevation, slope, and aspect to each buffer. The clipped rasters were used to find mean values within territories. We then selected twice as many arbitrary locations within the search area and determined elevation, slope, and aspect values for each. We used F-tests to test for differences in variance between Ovenbird and arbitrary sites for those variables. T-tests were used to test for differences between means. In the case of unequal variance, T-tests were replaced by Mann Whitney. F-tests found significantly less variance in slope and aspect for sites with Ovenbirds than

arbitrary sites. The T-test (for elevation) and Mann Whitney tests (for slope and aspect) found no differences in means for elevation, slope, and aspect. These results suggest an appropriate model for predicting Ovenbird occurrence could be developed using their occurrence along a narrow range of aspect and slope values.

57 - Hooded warbler (*Setophaga citrina*) occurrence in relation to vegetation structure and the presence of invasive plant species at the Lillian E. Smith Center, Rabun County, Georgia

Austin Miller, Timothy Menzel

Piedmont College, Demorest, GA

The Lillian E. Smith (LES) Center is located in Rabun County, Georgia and includes approximately 150 acres of undeveloped creek bottom and mountain slope. Previous research at LES has found the hooded warblers there to be associated with high levels of vegetation structure. Invasive plant species likely contribute to this vegetation structure and are prevalent within the creek bottom area where these warblers are found. This project was undertaken to answer the following questions: 1) What is the relationship between the occurrences of hooded warblers and invasive plant species at LES? 2) Do invasive plants contribute to the vegetation structure that is favorable to hooded warblers? Vertical vegetation cover was quantified at 3 height intervals, at locations with hooded warblers and at twenty arbitrarily selected sites within the hooded warbler's general habitat. The occurrence of invasive plant species was also noted for hooded warbler and arbitrarily selected sites. Multiple Response Permutation Procedure (MRPP) was used to test for a non-random relationship between vegetation structure and the occurrence of hooded warblers and between vegetation structure and the occurrence of invasive plant species. Chi-square was used to test for a relationship between hooded warbler and invasive plant occurrence. There were nine observations of hooded warblers. There was a non-random relationship found between vegetation structure and the occurrence of hooded warblers, but not between vegetation structure and the occurrence of invasive plant species. Hooded warblers did not occur in sites with invasive species more or less than expected by chance. Invasive plants are likely providing vegetation structure similar to that provided by native plants at LES and are providing habitat that is being utilized by this species.

58 - Genetic Diversity and Population Genetic Structure of Seep Endemic *Xyris tennesseensis*

Kala Downey, Carol Baskauf

Austin Peay State University, Clarksville, TN

Obtaining information about the distribution and levels of genetic diversity in rare species is important for prioritizing the protection of populations representing the bulk of the species' diversity. Genetic variation is required for long-term adaptive evolution, and loss of variability can cause inbreeding depression and impair growth and disease resistance in the short-term. This study examined the population genetic structure and diversity of *Xyris tennesseensis*, a federally endangered obligate wetland plant found in imperiled seep and riparian habitats. This species has a highly disjunct distribution encompassing 10 counties from three states. Five Tennessee, four Alabama, and five Georgia populations were sampled for this study, including some of the largest and most geographically distant *X. tennesseensis* populations in each state. An average of 28.5 plants were sampled per population, and 14 polymorphic nuclear microsatellite markers were assayed to determine the species' genetic structure and diversity. Results showed limited variability, with an average of only 16% polymorphic loci per population. The average observed heterozygosity was unexpectedly low at 0.017, resulting in a relatively high F_{IS} of 0.71and suggesting high levels of inbreeding. Two Alabama populations contained the majority of within-population diversity, whereas most others appeared to be genetically depauperate. Analysis of molecular variance estimated that differentiation among the states accounted for 60% of the genetic variation in this species, with an additional 31%

due to genetic differences among the populations of each state and only 9% due to variability within populations. These data indicate *X. tennesseensis* possesses low levels of genetic diversity and that there is very little, if any, gene flow among the populations. To preserve what remains of the genetic variation of this species, it is essential that multiple populations be protected, with priority given to the largest and most diverse populations in each state.

59 - Assessing Geographic Patterns of Genetic Variation and Gene Flow in North Carolina Populations of the Gopher Frog (*Rana capito*)

Nathaniel Akers, Brian Arbogast

University of North Carolina Wilmington, Wilmington, NC

The gopher frog (*Rana capito*) is considered a threatened species in North Carolina (NCWRC 2014). Gopher frogs primarily occur in long leaf pine forests, which have suffered a 97% reduction in distribution due to fire suppression and development over the last century. Now, many species associated with this habitat type are considered threatened or endangered. Prior studies have produced broad-scale genetic information for gopher frogs from across their range in the southeastern United States, but little fine-scale genetic data are available for the seven known populations of gopher frogs in North Carolina. There is a need to obtain such information on gopher frogs in North Carolina in order to effectively manage the species in the state. Understanding the genetic architecture of gopher frogs will provide critical information necessary for conservation practices, including potential translocation of frogs between sites or augmentation of small populations with individuals from larger populations of this species. We will obtain multi-locus genetic data from gopher frogs from as many of the remaining sites in North Carolina as possible by genotyping individuals using microsatellite markers and examining mtDNA sequence variation. These data can be used as a framework for guiding conservation and management decisions for gopher frogs in North Carolina.

60 - The Hunt for Bigleaf

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Rare trees are invaluable for the ecological niches they fill, supporting ecosystems and having potential economic and medicinal values. The bigleaf magnolia is no exception. This aptly named magnolia is a spectacular understory tree that has leaves up to 1 m long and .5 m wide, unlike anything else found Arkansas! With only one wild population documented west of the Mississippi River, this population is in danger of being lost. Although vouchered specimens exist, the location of this tree remains a mystery. The specimen labels contain errors in counties and coordinates that make it unclear if all known Arkansas specimens have come from a single population or multiple populations in Northeast Arkansas. The mission of this research project is to identify these locations, conduct a thorough search of last-known possible locations to determine if there are living trees in these populations, and to categorize habitat metrics to aid in searching for unknown populations. Located trees will be documented and records shared with the Arkansas Natural Heritage Commission for further study and preservation of the native genotypes. Failure to locate any trees of this species in Arkansas could result in an ecological restoration project for this species.

61 - The influence of chronological age on the occurrence of intersex in Largemouth bass, *Micropterus salmoides*, in the Chattahoochee River drainage, Georgia.

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Previous studies have shown the presence of intersex in Largemouth bass (*Micropterus salmoides*) of the Chattahoochee River; however, the potential relationship between age and intersex is still unknown. Intersex is a phenomenon where a gonochoristic organism shows the gonadal tissue of the opposing sex. We hypothesized there would be a positive correlation between age and the prevalence of intersex because older fish have experienced endocrine disrupting compounds (EDCs) found in the water longer. Largemouth bass were collected from Lindsey Creek and Heiferhorn Creek to assess the prevalence of feminization in the watershed. Lindsey Creek is a highly altered channel with a poor riparian zone making it more vulnerable to the many sources of industrial, commercial, and urban runoff. Heiferhorn Creek is comparatively more pristine with a large riparian zone without many agricultural or commercial properties adjacent to the stream. The 16 (Lindsey=6, Heiferhorn=10) male Largemouth bass collected from both streams to date, exhibit no evidence of intersex. The sampled fish ranged in age from 1 to 5 years, sizes varied from 6.5 cm to 29.0 cm and weights varied from 2.58g to 340.62g. Our next goal is to examine Largemouth bass for age-related intersex from the Chattahoochee River.

62 - Investigating the effect of oxygen circulation on basil plant growth in an aquaponics system

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Aquaponics is a sustainable food production system that combines plant growth via hydroponics and aquaculture. Specifically, fish tank water is circulated through plant grow beds where excess nutrients (e.g., nitrogen) are absorbed and used for plant growth,and then returned to fish tanks, thereby reducing the necessity of water changes for fish production and fertilizer additions for plant growth. However, the operating costs of aquaponics systems, specifically those associated with the electricity required to continually oxygenate water and the procurement of pelletized fish food, remains a major obstacle to the development of a thriving aquaponics industry. The aim of this study was to investigate if oxygen circulation within plant grow beds is necessary to maximize plant nutrient uptake and productivity. Specifically, plant height was measured weekly over four months for basil (*Ocimum basilicum*) located in the upper part (nearest fish effluent input), middle part, and lower part of grow beds with and without oxygen circulation. At the end of the four month period, plants were harvested and aboveground and belowground biomass was measured. Results showed significantly greater aboveground biomass, final plant height, and growth rate for plants in grow beds without oxygen circulation, suggesting that oxygen circulation does not maximize plant productivity for basil growing in an aquaponics system. However, results also showed that plant location within the grow beds strongly influenced plant growth, with significantly greatest aboveground biomass, belowground biomass, final plant height, and growth rate for plants grown in the upper parts of the grow bed. The results of this study can provide information to aquaponics facilities on how to best maximize plant growth, especially for basil, while fostering profitability of these systems through electricity cost savings.

63 - Fish Species Diversity and Abundance in a First-order South Carolina Stream

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Fish abundance and diversity in Cox Creek, a first-order, Piedmont stream, Anderson County, SC were determined during Fall and Winter 2017-18. Surveying was done using a backpack electrofisher and dipnets at three stations of ~120 m length (3 m X 40 stream widths). Results were compared with those from a similar study completed in 2015. Twelve species comprising six families were collected compared with ten species in six families in 2015. The most

abundant species collected in the current survey was *Gambusia holbrooki*, Eastern Mosquitofish; in 2015 *Notropis lutipinnis*, Yellowfin Shiner was the most abundant. *Nocomis leptocephalus,* Bluehead Chub was the second most abundant species collected in both years. Moderate to extreme drought conditions prevailed during most of the interval between surveys, and rainfall that did occur was often brief, but intense, resulting in rapid increases in stream volume and velocity. Diminishing stream margin vegetation cover and an increase in the area of impervious surfaces in the watershed contributed to the "flashy" flow regime. An increase in the proportion of silt in the substrate (silt, sand and fine to small gravel) was noted compared with the 2015 data. Refuges for fishes during elevated stream volume and flow include overhanging banks, with and without vegetation, woody debris and crayfish holes in clay along creek margins. The increase in *G. holbrooki* numbers is likely due to their ability to tolerate siltation, lower dissolved oxygen and higher temperatures compared to many other species. They are also known as aggressive competitors in communities of small-sized fishes. Despite urbanization and drought conditions, the 5-6 km urban stream can be considered reasonably healthy with the presence of *Hypentelium nigricans*, Northern Hogsucker and *Percina nigrofasciata*, Blackbanded Darter and many aquatic insect larvae observed.

64 - Investigation of the presence and identity of polychlorinated biphenyl (PCB) congeners in the Coosa River and its Rome tributaries in Floyd County, GA.

Christopher Elsey, Jacob Case, Daniel Clayton

Shorter University, Rome, GA

Since 2003, there have been excavations to remediate PCB-contaminated soils from property associated with Rome, Georgia's General Electric plant. PCBs [polychlorinated biphenyls] are known carcinogens, and are a persistant pollutant documented to bioaccumulate in fatty tissues of living organisms. Two streams and adjacent lands have received remediation activities to remove and dispose of contaminated soils that drain into these waterways; Horseleg Creek and Little Dry Run Creek. This undergraduate research study investigates the presence of residual PCBs in aquatic habitats. In the preliminary phase of this investigation, environmental samples are processed using soxhlet extaction and GC/MS analysis to isolate, separate, and detect the presence of PCB congeners; dichlorobiphenyls or trichlorobiphenyls, for example. Comparison of Rapid Assessment assays published in the literature will be compared to GC analytical findings from this study. Preliminary data does not support the presence of PCBs in Horseleg Creek or Little Dry Run Creek, but samples are still being collected and analyzed. This project is funded by a TriBeta National Biological Honor Society Undergraduate Research grant.

65 - Impacts of a chicken processing plant on phosphate and bacteria concentrations in an adjacent wetland and creek.

John Bryant, Elizabeth Dobbins

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Alabama is third in the nation in broiler chicken processing with 19 major facilities in the state. The impact of these facilities on Alabama rivers and wetlands is not well established, and many plants are near rural communities that use waterways for recreation and food sources. A major chicken processing plant in Blount County releases water into a wetland that empties into Graves Creek in the Black Warrior River watershed. We evaluated water at the surface and at the mud-water interface at the bottom of the water column for pH, conductivity, phosphate, and bacteria. We hypothesized that there would be decreased pH and elevated conductivity, phosphates, and E Coli downstream of the wetland compared to upstream. There were no significant differences in pH, but conductivity and phosphates were significantly elevated downstream and in the wetland. E coli was not elevated in surface water but was at

the mud-water interface. Phosphate concentrations in the wetland were an order of magnitude higher at the mud-water interface (> 500 ppm) than at the surface. PCR demonstrated that there were fecal bacteria (*Bacteroides*) in the wetland.

66 - Can you hear me now? Acoustic communication in Centrachids

Matthew Binchik, Michelle Gallo, Jeff Steinmetz

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Acoustic monitoring of underwater fauna has almost exclusively focused on marine species. In contrast, very little is known about the acoustics of freshwater species and few sounds have been documented. A few studies have documented calling in Centrachids. In freshwater bluegill (*Lepomis machrochirus*), for example, research has found that 'drumming' or 'knocking' sound patterns occur during the breeding season. Very little information has been documented about off-breeding season calls. Here we report acoustic communication in bluegill and redear sunfish (*Lepomis microlophus*). These trials consisted of three phases. First, field recordings were conducted at The Cheraw Fish Hatchery in Cheraw, SC. Acoustic signatures and call patterns for bluegill and redear sunfish were recorded for one week in August and one week in September 2016. A Wildlife Acoustic Song Meter equipped with a hydrophone recorded for 30 minutes every hour for both of those weeks. The calls that were recorded were typically low frequency "grunts" under 1KHz, in bursts of single, double, triple or multiple amplitudes. There were peak calling rates around 10:00 and 16:00 hours. Next, lab recordings were conducted both in 2016 and 2017 using samples of 8 and 12 adult bluegill respectively. Preliminary results show similar patterns to the field recordings. The third part of the project was conducting behavioral experiments on bluegill to try and understand why they were calling. Trials included: males by themselves, females by themselves, two males, two females and one male and one female. In addition, we also used an underwater speaker to playback previously recorded sounds to both males and females in order to attempt to invoke behavioral responses. Hopes to build on this work in the future include: expanding the study to additional species, as well as more behavioral trials to further understand the function of calls during breeding and non-breeding seasons.

67 - Effects of Low Level Atrazine Exposure on Crayfish Development

Nathan T. Chandler, Abbie H. Suttle, Austin M. Minuto, Samuel M. Owens, Mackenzie Lecher, Caroline V. Williams, Shiloh Sooklal, Alexandra Reddy, Todd Allen, Mark Blais, Kyle J. Harris

Liberty University, Lynchburg, VA

Chemical control of unwanted target organisms is a common practice in agricultural, recreational, and suburban areas throughout the United States. However, non-target organisms within freshwater ecosystems can be exposed to a variety of these chemicals at low doses. The extent of this exposure on non-target organisms is not fully understood. The common use of the herbicide Atrazine (ATZ), a chemical pollutant found in freshwater, is known to result in endocrine disruption in organisms. One such non-target organism, crayfish, are abundant throughout freshwater streams and are likely to be exposed to ATZ. Previous findings (Chandler et al., 2017) involving a range of concentrations from 0.5-5.0 µg/L revealed an increase in tissue degradation as ATZ concentration increased. In this current experiment, a sample of forty juvenile crayfish were collected from a central Virginia stream and have been exposed to low dose ATZ concentrations (0.05, 0.5 and 5.0 µg/L) for four months and were then moved to separate study tanks for additional growth prior to tissue analysis. Carapace length (CL), total length (TL), and blotted wet mass (BWM) were taken at monthly intervals over the course of study to assess for the effect of ATZ on crayfish growth. On average, 70% of the crayfish within each treatment (0.0 – 5.0 µg/L) survived for assessing effects of ATZ on growth and development. Reproductive tissue will be removed from crayfish for assessment of

tissue degradation due to ATZ endocrine disruption using H&E and DAPI staining techniques. Based upon previous findings at higher ATZ doses (5.0-50 µg/L) it is expected that reproductive tissue will contain observable differences between control and experimental groups (e.g. tissue degradation) from low dose (0.05-5.0 µg/L) ATZ exposure. Findings may be used to further the development of best practices in relation to how chemical use impacts both target and non-target organisms.

68 - A stream continuum analysis of bacteria community assembly in association with crayfish and their symbionts.

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Microbial community assemblages have long been understood as key components within freshwater ecosystems (e.g. nutrient cycling). However, patterns of microbial presence and persistence along stream continuums, in relation to specific host organisms, have been understudied. The identification of such patterns may provide additional insight into the dynamics of microbial framework patterns, and how such patterns may shape other community assemblages. One such pattern observed in a recent lab-based experiment involved crayfish with and without branchiobdellidan ectosymbionts (Cooke et al., 2017). Microbes isolated, and sequenced, from this study revealed that different bacterial taxa were present on those crayfish with symbionts and those without symbionts. This study seeks to build on these previous findings, expanding microbial collection to a local stream in order to observe microbial community assembly on crayfish with and without ectosymbionts, to see if similar assembly patterns exist within a physical stream continuum. Ten crayfish and six environmental microbial samples were obtained from five different collection sites along the length of the Opossum Creek Tributary, using aseptic techniques. Any branchiobdellians observed on the crayfish were removed for identification and assessment. The bacterial swabs were taken back to the lab, and their DNA extracted using a Qiagen Blood and Tissue Kit. After extraction, PCR and qPCR will be performed for 16s gene amplification and quantitative analysis. The 16S gene will be sequenced and used in comparison to sequences within the BLAST database for taxonomical identification of microbes. It is hypothesized that shifts in bacterial makeup and community assembly will be observed not only in the environment (water and substrate), but also on the crayfish, as samples are compared along the continuum length and in relation to ectosymbionts.

69 - Identification of Parasites in Intermediate Hosts of Freshwater Digenetic Trematodes

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Alabama is home to the some of the highest diversity of freshwater snails in North America and these snails are often the first intermediate host in the complex life cycle of digenean trematodes. Black spot disease is a condition often seen in fish in the southeastern United States caused by the encysting of the metacercariae of a digenean trematode on the host's superficial layers. While behavioral studies have been conducted on the potential effects of this parasite on the fish host, there has been little research on its freshwater snail host. The trematode that causes BSD in the western mosquitofish, Gambusia affinis, is Uvilifer spp., said to require a planorbid snail as its first intermediate host; however, these snails may be extremely rare (or possibly absent) at sites where BSD is present. It is currently unknown whether Uvilifer spp. utilizes freshwater species other than those belonging to Planorbidae as an intermediate host. Trematode samples from sites with freshwater snails (Elimia and Physella) and infected Gambusia affinis were genetically tested for identification of trematode

species. If Uvilifer spp. is found in both the snail and fish samples, then it will be evident that the trematode is able to use multiple snail species as an intermediate host.

70 - Prevalence of Trematode Parasites in a Population of a Freshwater Snail, *Elimia sp.*

Jessica Yeager, Aurora Green, Terry D. Richardson

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Snails of the genus *Elimia* are common to streams of the southeastern U.S. and serve as an intermediate host for trematode parasites. Parasitism greatly affects the reproduction of these snails and can impact their population dynamics. Little research and data has been completed on the distribution of the trematodes within the populations of *Elimia*. In this study the percentage of snails parasitized among different size classes was quantified and parasitism in the different sexes was compared. One hundred snails a month were collected from a tributary of the Tennessee River; 50 from upstream above a beaver dam and 50 downstream below the dam in flowing water. Snails were measured, sex identified, and infestation determined using a dissecting microscope. Snail width ranged from 3.0-8.0 mm and snails tended to be larger at the upstream site than downstream. Snail infestations began in snails 5.0 mm and prevalence increased as snail size increased at both upstream and downstream locations. This produced a higher prevalence in the overall larger upstream snails. Sex rations did not differ between upstream and downstream locations (≈ 1:1), but more of both sexes were infected at the upstream site. Trematode prevalence is size-dependent, but not different between sexes. Larger and therefore older snails may have a higher probability of being infected thus creating a higher prevalence in the larger individuals.

71 - Host Specificity of the Leech *Placobdella biannulata* on Appalachian Salamanders

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Parasites are either host specific or host general depending on the species. The leech *Placobdella biannulata* parasitizes dusky salamanders (*Desmognathus*). Because higher leech incidence is related to increasing aquatic tendencies of the host species, it has been hypothesized that this leech is a host generalist. This hypothesis was tested using two cryptic species of *Desmognathus*, *D. quadramaculatus* and *D. folkertsi*, which are sympatric and have the same level of aquatic tendency. This leech species has been reported to occur on both species. Salamanders were collected at two sites: Sosebee Cove and Helton Creek, in Union County, Georgia. Leeches were counted, and a contingency analysis was used to test for randomness of leech incidence between the two host species. Five of 19 (~26%) *D. quadramaculatus* and 0 of 54 *D. folkertsi* had leeches at Helton Creek, a significant difference in leech distribution between species (χ^2 = 12.021; P = 0.0005). At Sosebee Cove 14/69 (~20 %) *D. quadramaculatus* and 0/38 *D. folkertsi* had leeches, a difference that was also significant (χ^2 = 8.871; P = 0.0029). Our results indicate that *P. biannulata* is more host specific than previously thought.

72 - Chronic study on the effects of gibberellic acid (GA3) on the mortality and reproduction of freshwater daphnids

Fernando Cardenas

1949, Charlotte, NC

Gibberellic acid (GA3) is a plant hormone that is used in agriculture to increase crop yield and could pose a threat to aquatic life as the GA3 run-offs to a larger source of water. A recent acute study found that the LC50 for GA3 to *Daphnia magna* is 143 mg/L, a concentration that

is rarely found in the environment. We performed a chronic study conducted to evaluate whether prolonged exposure to GA3 causes adverse effects on reproduction or survival of *D. magna*. A total of 80 *D. magna* were exposed to GA3 at four different concentrations (100 PPM, 1 PPM, 0.1 PPM, and control), and were divided into 4 *D. magna* per jar, and 5 jars per concentration. We chose 1 and 0.1 ppm to represent more realistic exposure scenarios to compare to the higher concentrations that cause mortality. The experiment lasted 53 days and water was changed twice weekly and GA3 was re-spiked following water changes. Results showed that there is no significant difference in the mortality or reproduction of the *D.magna* between treatments indicating that neither acute nor prolonged exposure to GA3 from agricultural uses is likely to adversely affect *Daphnia magna* populations in the field.

73 - Comparison of age and growth biology of 34 million year old stingrays from North Dakota to the extant *Dasyatis pastinaca*

Persia Tillman[1], Michael Newbrey[1], Clint Boyd[2], Todd Cook[3]

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Stingrays are a diverse and popular group of vertebrates; however, nothing is known about the relationships between growth biology and climate change. Our goals were to provide a synopsis about the age and growth of freshwater stingrays and compare them to 34 million year old freshwater stingrays that were living during a cooling climate in North Dakota. The Earth's climate cooled from 50 to 33 million years ago when many warm adapted organisms were relegated to warmer, southern latitudes in North America. Today, freshwater stingrays only inhabit subtropical and tropical environments. We predicted the fossil stingrays from North Dakota to grow very slow compared to their modern counterparts. We examined 36 isolated vertebral centra from a riverine fossil locality (Medicine Pole Hills local fauna) in the Chadron Formation of North Dakota. Age (years) was estimated from the number of growth cessation marks on each centrum. Centrum radial distance (mm) was measured from the notochord foramen to each annulus and plotted. Chronological ages ranged from 0 to 5 years old and centrum radial distances ranged up to 1.7 mm. We could not find any published data on age and growth of extant freshwater stingrays for comparison. The growth profiles were compared to marine *Dasyatis pastinaca*, Common Stingray, which are found in Northeastern Atlantic Ocean. There is complete overlap in the von Bertalanffy growth curves and parameters of the two datasets with no evidence for slow growth rates from ages 1-7 years old. There is no evidence of old individuals in the fossil dataset suggesting two hypotheses; 1) older individuals did not exist in the population, and 2) older individuals lived in another habitat (habitat partitioning). The use of fossils stands to provide great insight into the effects of climate change on the age and growth biology of fishes

74 - Indirect Effects of Inter-Kingdom Competition and Predator Cues on an Aquatic Vertebrate

Danielle Kirsch, Thomas Hastings, Jon Davenport

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Within aquatic food webs, there are many types of species interactions. Exploitative resource competition and non-consumptive predator effects are two such interactions in which organisms indirectly affect one another. In some aquatic food webs, largemouth bass are top predators that consume prey (e.g. larval bluegill) directly while also indirectly affecting growth by reducing prey foraging and activity. Larval bluegill feed predominantly on zooplankton, which are also the primary prey item for bladderwort, an aquatic carnivorous plant. Recent research suggests that these two species will compete for zooplankton as a food resource, thus providing an example of inter-Kingdom competition. Therefore, we initiated a study to examine how the strength of resource competition between bluegill and bladderwort varies in

the presence of a top predator, the largemouth bass. We set up an artificial pond experiment that fully crossed the presence of caged largemouth bass with the presence of bladderwort in four food webs. The experiment ran for one month during which we measured changes in bluegill growth and behavior. We hypothesized that bluegill performance would be more reduced in food webs with caged bass and bladderwort combined compared to other food webs. There were no significant differences in bluegill growth among the different food webs. However, bluegill activity was greater in bluegill control food webs relative to the other food webs. Our results demonstrate the complexity of interactions across Kingdoms and how they may cascade in unexpected ways within aquatic food webs. The bluegill-bladderwort-bass dynamic highlights the importance of considering the multiple avenues in which indirect effects can change species interactions within aquatic food webs.

75 - The effectiveness of underwater visual census and seining in measuring fish abundance and diversity in three Central Florida springs

Coramarie Jennings, Kirsten Work

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Various methods, such as seining and underwater video census (UVC), can provide information about an ecosystem's fish abundance and diversity. However, each technique has limitations, and these limitations can vary depending upon water clarity and the available structure in the census area. Fish species richness, density, and diversity were evaluated with UVC and seines at various points along three Central Florida springs that varied in available structure and water clarity: Blue Spring, Gemini Springs, and Rock Springs. At each spring, 12 minutes of video were collected with two GoPro cameras at four to five sites on either bank of the spring. After each video was complete, the site was seined toward the camera, thereby collecting both the fish and the camera. The UVC captured the same number of individuals as the seine; however, the UVC captured an equal or greater number of species, which translated into equal or greater diversity as the seine. Therefore, we conclude that UVC is as effective as seining in clear water, but more research is required to determine the effectiveness of UVC in other types of water bodies than clear water springs.

76 - Spatial Ecology of Fish Communities in Accokeek Creek, Virginia

Kait Brogan, Bradley Lamphere

University of Mary Washington, Fredericksburg, VA

Stream complexity and structure are vital influences on the composition of the fish communities living in them. We sampled fish communities along the length of Accokeek Creek in Stafford County, Virginia, to test the influence of biotic, abiotic, and anthropogenic factors on species composition. At each of five sites, we recorded the identity, number, and total length of each fish captured, along with water quality data, including temperature, total dissolved solids (TDS), pH, and specific conductivity. We also collected land use data for the upstream watershed at each sample point. The most upstream sample site was located in a construction area for new residential development. Downstream sites sampled Accokeek Creek is it passes through Crow's Nest Natural Area Preserve and into the Potomac River. We summarized fish community composition using diversity indices and ordinations, and used those data to assess their correlation with abiotic and land use variables. Longitudinal studies such as this can show the impact of site- and watershed-level effects on biotic communities and water quality in streams.

77 - Investigation of Cohort Structure in the Invasive Aquatic Snail, *Bellamya japonica* (von Martens 1861)

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The invasive freshwater snail, *Bellamya japonica* (von Martens 1861), is a well-known invasive in habitats throughout North America. While its basic biology is well-known, little is understood of its ecological interactions. Our understanding of their population dynamics has suffered from an inability to determine even such characteristics as lifespan. Our studies have shown that in temperate climates, there is a seasonality to their production of offspring. They have the greatest fecundity in spring and early summer with little or no reproduction during colder fall and winter months. Because of this trend, our recent investigations have attempted to discover a means of identifying cohorts in order to better understand their overall population dynamics. We employed several morphological measures to compare two established populations of *B. japonica* which appear to have different growth characteristics. Populations in Lake Greenwood (SC) have the same seasonality as in Lake Hartwell (SC) but have individuals of much greater size and shell characteristics than those from Lake Hartwell. Females from Lake Greenwood also tend to have greater maximum numbers of offspring although the offspring themselves seem to be similar. In past studies, we speculated that this difference was due to nutritional differences between the two lakes. We also understand that maximum lifespan may differ between the two lakes, which could also contribute to the observed differences. In this study we compared the allometric and morphological characteristics of these two populations in order to discover a means of defining population cohorts. If successful, this would provide a better basis for other ecological comparisons. By applying exploratory data analysis to a large comparative dataset, we report here what our current observations are and how they might be improved. The study is ongoing and, once completed, will compliment other descriptive and experimental studies on this invasive species.

78 - Habitat and community differences in the historic and current range of the Buck Darter *(Etheostoma nebra)*

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The Buck Darter (Etheostoma nebra) is a recently described species of darter, native to the Buck Creek system in southeastern Kentucky, that is critically imperiled. Past collection records from 1955-1981 show that the buck darter was once found throughout the Buck Creek system, whereas now it is limited to only two small tributaries: Big Spring Branch and Stewart Branch. It has not been determined whether the loss of habitat was random, or if there are conditions in Big Spring Branch and Stewart Branch that have allowed the species to remain. The objective of this study was to compare and contrast the habitat, fish communities, and land use at historical locations, as well as the locations where the species is currently found. Six historical headwater streams in the Buck Creek system were studied along with the two streams where the Buck Darter is currently found. All streams were compared using hierarchic clusters to determine how similar the sites were to one another, and variables from the habitat and land use were used to determine which variables were correlated with Buck Darter abundance. Big Spring Branch and Stewart Branch were more similar to each other than they were to any other stream, indicating that something about these streams allows the species to persist, and that the range has not randomly decayed. Conductivity of the water, number of springs in the watershed, and percent land cover in the watershed that was evergreen were

found to be associated with the Buck Darter. These variables may be good candidates for further research to determine what conditions the Buck Darter needs to survive.

79 - The effects of predation pressure on pectoral spine allometry in Margined Madtoms (*Noturus insignis*)

Peter Grap, Bradley Lamphere

University of Mary Washington, Fredericksburg, VA

Madtoms, like many catfish, have venom glands surrounding their pectoral and dorsal spines, which act as delivery structures. Previous studies have provided evidence that the venom glands possessed by madtoms are anti-predator adaptations that cause predators to reject them. While studies have been conducted to investigate the evolution of the venom, we know of no studies that have investigated the evolution of structures that deliver the venom. This study investigates the affects that predation pressures may have on the morphology of the pectoral spines. We compared the relative size of the pectoral spines to the body size of margined madtoms (Noturus insignis) in the Rappahannock River drainage. Individuals from a range of sizes were collected at a downstream site and an upstream site, where there are fewer large piscivores. We compared allometric curves from both sites in order to test the hypothesis that the relative size of the spines would be larger in the downstream site where there are more large piscivores. Field studies of morphology such as this can reveal how predators shape the evolution of their prey.

80 - Mercury Concentrations in Terrestrial and Aquatic Primary Consumers in Tennessee's Appalachian Mountains

Jaylen Sims, Gale Beaubien, Connor Olson, Andrew Todd, Ryan Otter

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The Appalachian Mountains are typically thought of as pristine, but due to their high elevation and location, they are susceptible to atmospheric deposition of non-point source contaminants such as mercury. Mercury is traditionally thought of as an aquatic problem because once it reaches the aquatic environment, sulfate-reducing bacteria may convert mercury into its bioavailable form, methylmercury. Previous research has shown that methylmercury can bioaccumulate in primary consumers and biomagnify through aquatic and terrestrial food webs. The objective of this study was to determine if terrestrial and aquatic primary consumers have comparable mercury concentrations. To determine this, an aquatic primary consumer (caddisflies, Order: Trichoptera) was collected at four sites spanning the latitudinal gradient of Tennessee's Appalachian Mountains. Additionally, a terrestrial primary consumer was sampled concurrently; millipedes (Class: Diplopoda) were collected at three sites and terrestrial snails, (Class: Gastropoda) were collected at one site. Whole-body homogenates were analyzed for total mercury concentrations, and subsamples were analyzed for methyl-mercury. Results show that total mercury concentrations in millipedes (470±110 µg/kg) and snails (16.2±5.66 µg/kg) exceeded total mercury in aquatic primary consumers (3.3±.18 µg/kg). Currently, no explanation can be given on why millipede mercury concentrations were over an order of magnitude greater than the aquatic primary consumer used in this study.

81 - Land use change and fish assemblages in Spotsylvania Co., VA from the 1980s to the present

Alyssa Zanzucchi, Bradley Lamphere

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Over the past 35 years Spotsylvania County has undergone a rise in residential and commercial land uses from the previous highly rural and agricultural areas. Land use changes are especially problematic in temperate areas such as Virginia due the numerous streams and wetlands present. Development near fluvial systems can have an effect on the local fish assemblages in the streams in terms of habitat loss or fragmentation, as well as water quality issues concerning polluted runoff from nearby impervious surfaces. We investigated the fish assemblage changes in response to land use development from the 1980s to the present. Fish assemblage data retrieved from samples taken in the 1980s in Spotsylvania County was recovered from the University of Mary Washington archive, and samples were also taken from the same sites in the present to compare the results. Land use data from the 1980s was taken from the 1987 Spotsylvania County Land Use Comprehensive Plan, and present land use data was extracted from GIS maps of Spotsylvania County land use and land cover data. Fish assemblages from past and present data were then categorized based on the abundance of tolerant, generalist, and native species to assess the effects of land use changes from rural to commercial environments on the fish community. We hypothesized that there would be a greater number of tolerant, generalist, and non- native species following the rise in development since the 1980s. Understanding fluvial and biotic responses to urbanization can help in future planning of land use when developing near freshwater systems.

82 - HPLC Detection of the Possible Presence of 17-α-ethindyl estradiol in Treated Effluents Released from the Chattanooga Water Treatment Plant

Jacqueline Dulanto

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Research has confirmed that elevated synthetic estrogen in surface waters can lead to intersex characteristics in aquatic vertebrates. Unmetabolized antibiotics, hormones from animal wastes, including humans, and discarded pharmaceuticals are some ways synthetic estrogen enter aquatic ecosystems through the release of contaminated effluents. In this investigation, the Agilent 1260 Infinity HPLC was used to detect the possible presence of 17-α-ethindyl estradiol in effluents released from the Chattanooga Sewer Treatment Plant. Results were analyzed by comparing HPLC chromatograms from effluent and spiked samples. We detected a possible peak of synthetic estrogen in the effluent samples with a retention rate of 6 minutes detected at 280 nm. This method could be used to determine if synthetic estrogen is present, within the mdl, in the Tennessee River at various distances downstream from the Chattanooga Sewer Treatment Plant and to compare these levels with those documented as being able to feminize male fish.

83 - A comparison of the number of growth cessation marks in otoliths and centra of Largemouth bass, *Micropterus salmoides*

Malina Rollins, Michael Newbrey, Elizabeth Klar, Jeramy Belt

Columbus State University, Columbus, GA

Studies of age and growth provide information about fish population structure, sexual maturity, growth rate, longevity, and mortality, which should be known for proper conservation and management. Fish age can be determined by several methods; however, the most common methods include using hard parts, preferably otoliths (ear bones). Otoliths are commonly used as chronometers because they continue to grow throughout the lifetime of the individual. However, vertebral centra, which are commonly overlooked as a simple structure to extract and age, also continue to grow throughout the lifetime of the individual. Both structures record growth cessation marks (annuli), which can be counted to estimate the chronological age of the fish. This study compares chronological ages of otoliths and vertebral centra in *Micropterus salmoides*. Largemouth bass were sampled from Lindsey Creek (n =20), Heiferhorn Creek (n

=8), and the Chattahoochee River (n =1) in west central Georgia. Otoliths and precaudal vertebral centra were extracted from individuals ranging in size from 8 cm to 38 cm total length Translucent rings were counted and compared between otoliths and vertebral centra. Ages of individuals ranged from 0 to 6. The expected outcome is that there will be a 1:1 ratio between the chorological ages of otoliths and centra.

84 - Preliminary investigation of aquatic vertebrate diversity and anthropogenic impacts at Hurricane Creek, Lumpkin County, Georgia.

Cory Duckworth, Kayla Allen, Jasmine Williamson, Todd Bennett, Katelyn Shook, Isabella Michel, Kaitlin Pepper, David Patterson, Jessica Patterson

University of North Georgia, Dahlonega, GA

The aquatic ecosystems of North Georgia are constantly under pressures related to human activity. Understanding the effects, both positive and negative, of certain structures and activities on the diversity of aquatic fauna and stream health can provide useful insights for future conservation and maintenance practices. In this study, we focused on a segment of Hurricane Creek running along a loblolly pine forest in Lumpkin County, Georgia, scheduled for clearing in the fall of 2018. Following Georgia Department of Natural Resources (DNR) protocols and regulations, 250 fish representing 19 species were captured and identified using backpack electro fishers and nets within a 260-meter stretch. The assemblage is dominated by insectivorous cyprinid fish, indicative of a healthy aquatic habitat. Utilizing an aquatic vertebrate index of biotic integrity (IBI) on the sample gathered in correlation with parameters such as pH and a riffle/run habitat assessment, we determined that Hurricane Creek can be classified as in good health based on the IBI in the section we assessed. Given the projected future developmental activity along the stream segment investigated here, our preliminary assessment provides important quantitative, baseline data that can be used to measure the impact tree clearing, as well as other anthropogenic activities, has on the overall health and diversity of this aquatic ecosystem in the future.

85 - The Effects of Temperature on Exotic and Native *Daphnia* from the Mobile-Tensaw Delta

Melissa Pompilius, Robert Fischer

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Daphnia lumholtzi is a nonindigenous aquatic species (NAS) that has attracted considerable attention due to its rapid range expansion. D. lumholtzi was first detected in a Texas reservoir in 1991, and quickly spread to reservoirs across the U.S. In reservoirs, it was found that high thermal tolerance allows D. lumholtzi to exploit a vacant thermal niche during the seasonal decline of native Daphnia during summer months. Daphnia lumholtzi has since expanded beyond reservoirs into waterbodies throughout the U.S., but it is less clear what characteristics allow this ability to rapidly colonize novel environments. We monitored the zooplankton community structure in the Alabama Mobile-Tensaw Delta in order to determine whether D. lumholtzi has established a long term population in this environment and to compare the seasonal occurrence of D. lumholtzi to native Daphnia species. In monthly zooplankton surveys conducted from 2012-2014, Daphnia lumholtzi occurred throughout the year, together with D. ambigua, D. obtusa, D. pulex/pulicaria and D. laevis/magniceps, at mean temperatures ranging from 14°C to 37°C. Laboratory studies comparing thermal tolerances of D. lumholtzi and native Daphnia showed that the critical thermal maximum for all species was similar (38-39°C). There were also no significant differences in survival between D. lumholtzi and native species following exposure to typical summer water temperatures (32-35°C) in acute thermal tolerance assays. However, at temperatures representing summer water temperature extremes (37-38°C), preliminary data indicate that survival was higher in Daphnia obtusa compared to D.lumholtzi and D. ambigua. Our studies suggest that Daphnia lumholtzi is not

exploiting a vacant thermal niche in the estuary, and may not have a thermal tolerance advantage compared to native species in this environment. Current studies are investigating variation in life history traits between D. lumholtzi clones collected from reservoir and estuary populations and reared under summer thermal regimes.

86 - Freshwater Sponges are Prevalent in Western North Carolina and Host Diverse Microbial Symbionts

Allison Griggs[1], David Corcoran[1], Victoria Skelly[1], Christina Strobel[1], Cole Easson[2], Cara Fiore[1]

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Sponges are common in freshwater bodies around the world, but they are dramatically understudied compared to their marine counterparts. Because of this, data on freshwater sponge species distribution and ecological attributes are patchy and there are limited data on microbial symbionts of these sponges, a generally well-characterized phenomenon in marine sponges. Here, we identified several freshwater sponge species from rivers in western North Carolina and have begun monitoring physical and chemical factors (e.g., inorganic nutrients, organic carbon and nitrogen, temperature) that may influence their distribution and abundance in the region. We also we investigated the composition of the prokaryotic community for two abundant sponge species from western N.C. As many marine sponges contain diverse prokaryotic symbionts that that are geographically conserved and influence the ecological role of the sponge host in its habitat, we aimed to determine if a similar phenomenon exists for freshwater sponges. Separate individual sponges and river water were sampled for microbiome analysis from May to August, capturing potential seasonal variation in symbiont composition. Freshwater sponges analyzed here contained surprisingly diverse microbial communities that are distinct from ambient river water communities and included potentially sponge-enriched microbial taxa. The microbes observed in the sponges may have relevant functional roles in nitrogen and other nutrient transformations in their habitat, and these data suggest a potential evolutionary relationship with the sponge that may be crucial to their health and function. The data presented here represents the first of its kind from the geographical region and provide a foundation for future investigations into the biodiversity and ecological role of sponges in montane riverine habitats.

87 - Investigating the function of the xanthophyll cycle in the sand dune herb *Hydrocotyle bonariensis*

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Coastal sand dunes are abiotically stressful environments for native plant species. During the growth season, plants are exposed to multiple stress factors, including high incident sunlight that is most pronounced during midday. Thus, native sand dune species likely have mechanisms to safely dissipate excess absorbed light energy. *Hydrocotyle bonariensis* is a large-leaf clonal herb common to Georgia's sand dunes and has been shown to increase leaf inclination over the growing season to avoid high incident sunlight, resulting in increased photosynthetic efficiency. However, these studies suggest that there may be additional mechanisms used by *H. bonariensis* to avoid negative effects of excess light absorption. The xanthophyll cycle is a series of pigment conformational changes that has been shown to reduce the risk of photoinhibition, or decreased photosynthetic efficiency, in plants in high light habitats. The purpose of this study was to investigate the relationship between photosynthetic efficiency (measured as leaf chlorophyll content and chlorophyll fluorescence) and the

xanthophyll cycle in response to incident sunlight for *H. bonariensis.* Specifically, chlorophyll fluorescence was measured for naturally inclined leaves and experimental leaves restrained in a horizontal position in June, August, and September 2017. Leaf samples were then collected and are currently being analyzed for leaf chlorophyll content and xanthophyll pigment concentrations. The final results are expected to elucidate the relationship between photosynthetic efficiency and xanthophyll cycle activity. The results of this experiment will further clarify the avoidance and tolerance mechanisms exhibited by this species in response to high light in the sand dune habitat.

88 - *Aiptasia pallida* as a model organism for thermal stress in cnidarians

Milagros De Pasquale, Wilkin Muñoz, Tammy L. Laberge

Miami Dade College, Miami, FL

Given the potentially devastating effects of climate change on corals, understanding the defense mechanisms against thermal stress in cnidarians has become crucial. Heat shock proteins have been shown to protect and regulate cell function during stressful conditions. Previous studies have demonstrated that Aiptasia pallida, a robust sea anemone often used as a model cnidarian, responds to short periods of elevated temperatures by producing the heat shock protein 70 (hsp70), which is highly conserved evolutionarily. We therefore used A. pallida as a model organism for analyzing temperature effects on cnidarians. This study examines the expression of the hsp70 protein in A. pallida when exposed to increased temperatures. For this purpose, a saltwater tank was established and water conditions such as pH, salinity, ammonia, nitrite, and nitrate were measured three times a week to monitor formation of toxic substances. To maintain a favorable environment, the anemones were fed fish flakes once a week and artificial light was used to mimic natural light conditions. In order to determine protein expression, the anemones are subject to short periods of thermal stress (2 hours) after which they are allowed to recover for 24 hours. Subsequently, protein is extracted and assayed by standard methods. Other factors to be considered with A. pallida include the temperature at which these anemones expel their symbiotic dinoflagellates (zooxanthellae) as heat is applied. The data obtained from this experiment will be serve as a baseline for future genomic analyses investigating the thermal tolerance among individual cnidarians.

89 - The Genomic Effect of Heat Stress in *Aiptasia pallisa*

Wilkin Muñoz, Milagros De Pasquale, Tammy L. Laberge

Miami Dade College, Miami, FL

Climate change is currently affecting the ocean's ecosystems with rising sea temperatures contributing to repeated coral bleaching all over the globe. *Aiptasia pallida* is a small sea anemone that serves as a suitable model species to study various environmental effects on cnidarians. Production of heat shock proteins, specifically heat shock protein 70 (hsp70) has been demonstrated when corals and anemones are exposed to brief thermal stress, but levels of mRNA expression have not been examined to date for this protein in anemones. We therefore established a saltwater tank environment to maintain a population of *A. pallida* and monitored conditions such as pH, salinity, temperature, ammonia, nitrate, and nitrite concentrations. After environmental optimization, *A. pallida* can be exposed to brief periods of increased temperatures and monitored for its response to the thermal stress both behaviorally and metabolically. Primers have been designed to amplify hsp70 in *A. pallida* based on sequences available in Genbank. Extraction of RNA from both treated and control specimens will be used for comparison of hsp70 mRNA expression via quantitative PCR. Potential differential expression of hsp70 can then be used in future studies looking at the genomic response to thermal stress in cnidarians to try and determine which parts of the genome respond to rising sea temperature.

90 - Stable isotope analysis (δ13C and δ15N) of blood and skin from mid-Atlantic loggerhead sea turtles (*Caretta caretta*)

Samantha Badgett[1], Susan Barco[2], Amanda Williard[3]

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Stable isotope analysis (SIA) is a technique that detects C13 and N15 signatures in tissues, such as plasma, red blood cells, and skin. It's a useful technique for understanding diet and foraging locations in migratory species, such as sea turtles. Comparison of C13 and N15 values in known prey species which values obtained from predator tissue may provide insights into diet composition. SIA can also be useful in determining migratory patterns, because natural gradient of C13 and N15 values with changes in latitude. Other natural gradients exist between oceanic vs neritic habitats and pelagic vs. benthic foraging grounds, and this may also provide insight into habitat utilization of marine predators. In order to use SIA to assess foraging patterns in marine predators, one must understand isotope turnover dynamics in different tissue types. Tissues absorb C13 and N15 from the diet at different rates. For example, in sea turtles the red blood cells and skin have a longer turnover rate, about 4-7 months, compared with plasma, which has a turnover rate of less than 2 months. This goal of our study was to compare C13 and N15 values in various tissue types from loggerhead sea turtles (Caretta caretta) captured from the Chesapeake Bay during the summer, and to put these data in light of SIA signatures in common prey items. SIA of red blood cells, plasma, serum, and skin from dead stranded and live captured loggerhead sea turtles in Virginia will provide insight into foraging patterns during seasonal migration and residency in mid-latitude foraging grounds.

91 - Effects of Wildfire and Interguild Competition on Fungal Decomposition in Western North Carolina Forest Soils

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Soil-dwelling fungi provide numerous ecosystem services, most notably serving as carbon sinks and as nutrient cyclers via decomposition of soil organic matter. Dynamics between two groups (guilds) of fungi, plant root-associated ectomycorrhizae (ECM) and free-living saprotrophs, have been observed to significantly influence net decomposition rates. A decrease in decomposition due to interguild competition is typically, but not universally, observed, potentially due in part to differences between guilds in carbon sourcing. As post-fire remediators and pioneer species, fungi are particularly relevant to the study of ecosystem effects of forest fire. The outbreak of forest fires in Western North Carolina in 2016 provides a rich opportunity for research, especially significant considering the projected increase in wildfire with the progression of global climate change. Research plots were established in one such burn site, with three sets of paired burned/unburned plots containing subplots which were either trenched to disrupt ECM systems or left untrenched. By measuring soil CO2 efflux and decomposition of organic matter by mass in these plots over the period of a year, this study sought to elucidate the effects of fire upon ecosystem-level decomposition processes, and thus upon interguild fungal interactions. Lower rates of decomposition were predicted in untrenched plots than in trenched, and lower rates in burned plots than in unburned due to shifts in carbon-to-nitrogen ratio. Preliminary findings show greater soil respiration rates in unburned than burned when compared by trenching treatment, and greater rates in untrenched than trenched when compared by burn effects, in all statistically significant results.

92 - Germination of *Amaranthus caudatus* seeds when exposed to KCl

Christy Carter, Karla Rangel Silva, Sierra Kincaid

Wingate University, Wingate, NC

Cultivating salt-tolerant ornamental plants becomes of utmost importance as soils become more salinized world-wide due to crop irrigation, salt mining, and oil well drilling. In this investigation, we assessed the germinability of *Amaranthus caudatus* (Amaranthaceae), a common ornamental garden plant with known salt-tolerant relatives, when exposed to KCl. These findings were compared to those of a previous investigation regarding the germination of *A. caudatus* when exposed to NaCl, because seed germination percentages can change due to changes of dominant salt types in soils. A completely randomized design with four replicate Petri dishes of 25 seeds was used to assess the effects of increasing KCl concentrations (dH_2O (control), 1%, 2%, or 3%) on seed germination. Seeds were placed in a Percival incubator and were exposed to a 12-h light/12-h dark photoperiod at constant 23°C. Germination was observed daily for ten days. Germination in the control was 86±3% (mean±SE). A total of three seeds (one seed in each of three replicates) germinated in the 1% KCl treatment. No seeds germinated in the 2% and 3% KCl treatments. Germination recovery in the 1, 2, and 3% treatments was 52.5, 22, and 45%, respectively, indicating that seeds can recover after exposure to salinity. This was unlike *A. caudatus* seeds that were exposed to 2% and 3% NaCl, which demonstrated significantly reduced germination in the recovery phase at these concentrations and, therefore, a specific ion effect. Preliminary results indicate that KCl significantly reduces germination when compared to the control, that there is no difference in germination between seeds exposed to KCl or NaCl salts, and that seeds demonstrate higher rates of recovery in distilled water when exposed to KCl. Further investigations are warranted to assess tolerance to KCl at later stages of development.

93 - Morphological, Genetic, and Environmental Characterization of an Unusual Population of *Isoetes* (Isoetaceae, Lycopodiophyta)

Shannon Walker, Mac Alford

The University of Southern Mississippi, Hattiesburg, MS

A large and unusual population of *Isoetes* within the DeSoto National Forest along Hall Branch in Wayne County, Mississippi, was studied in order to determine if it is a new species of quillwort or a variation of the one primary species of the longleaf pine belt, *I. louisianensis*. *Isoetes louisianensis* is an endangered species of quillwort found in Louisiana and Mississippi. The Hall Branch population and specimens of known *Isoetes louisianensis* were examined comparatively based on morphology, megaspore ornamentation, examination of habitat characteristics, and phylogenetic analysis of DNA sequence data from the nuclear internal transcribed spacer 1 and 2 (ITS) and the 5.8S ribosomal gene. Some differences were discovered in megaspore ornamentation and habitat, and more significant differences were discovered in morphology. The purpose of this study is to augment scientific understanding of *Isoetes louisianensis*, as much about this species is still unknown due to many new, recent discoveries of populations, similarities in appearance with other species of *Isoetes*, natural occurrences in *Isoetes* of cross-fertilization with the production of sterile hybrids, variations in ploidy level, morphological plasticity resulting from environmental factors, and the need for scanning electron microscopy to carefully observe megaspore ornamentation.

94 - The impact of digging on the shape of rodent mandibles

Daniel Glidewell, Andrew McIntosh

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The rodent mandible has been extensively studied in the context of functional morphology. The consensus is that compared with the skull, mandibular shape is heavily influenced by selective pressures such as diet. Although this may be true, there has not been a comparative study using a sample of rodents representing the whole order of Rodentia in a phylogenetic context. This study used a sample of twenty genera with at least one genus represented from each major rodent clade. To show the influence of selective pressures on mandibular shape, the study concentrated on a group of subterranean rodents that use their large incisors to dig in hard soils (chisel-tooth digging). We compared lower incisors and mandibular shape of chisel-tooth digging rodents with non-chisel-tooth digging rodents to see if there were morphological differences between the two groups. The shape of incisors was quantified using incisor radius of curvature and second moment of area. Mandibular shape was quantified using landmark based geometric morphometrics. We found that lower incisor shape was strongly influenced by digging group using a Generalized Phylogenetic ANCOVA. A phylogenetic Procrustes ANOVA (Analysis of Variance) showed that mandibular shape of chisel-tooth digging rodents were also significantly different from the non-chisel-tooth digging rodents. Interestingly, phylogenetic signal of both the lower incisors and mandibular shape was significant. However, a previous study from the authors showed that the rodent cranium had a stronger phylogenetic signal than the mandibles in this study. In conclusion, we showed that although the mandible and incisor of rodents is influenced by function, there is also a degree of phylogenetic affinity that shapes the rodent mandible.

95 - Sexual selection on male and female Ebony Jewelwing damselflies

Anjali Batra[1], Suzanne Allison[2], Melissa Encinias[1], Idelle Cooper[1]

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Understanding the evolution of phenotypic variation requires that we identify how selection drives differences between sexes and species. Sexual dimorphism is often attributed to sexual selection and many studies show female preference for exaggerated male traits, including coloration, plumage, mating calls, etc. Few studies, however, measure the mating success of both males and females to identify what traits may be under sexual selection in both sexes. The Ebony Jewelwing damselfly, *Calopteryx maculata*, is used as a classic example of male territorial behavior and character displacement in sympatric populations with other *Calopteryx* species. In this multi-year study, we investigated what traits are under sexual selection in male and female *C. maculata*. We determined the mating success of both sexes in the field and measured the correlations between several phenotypic traits and mating success.

96 - Wolbachia Infection in *Trichogramma kaykai*

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Wolbachia pipientis is an intracellular symbiont of arthropods that is transmitted maternally through the cytoplasm of the eggs. An estimated 40-60% of all arthropods and many nematode species are infected. Wolbachia is commonly known to manipulate the host's reproductive system. This is including manipulative phenotypes referred to as cytoplasmic incompatibility, male killing, feminization, and parthenogenesis induction. *Trichogramma kaykai*, is a parasitoid wasp infected with a strain of *Wolbachia* that induces parthenogenesis, which feminizes male embryos, allowing the infected females to reproduce asexually. One of the genetic consequences resulting from asexual reproduction is a loss of recombination. Since *Wolbachia* has the potential to spread rapidly through populations, this loss of genetic recombination has severe consequences for the evolutionary fitness of host populations. The present study examines the experimental introduction of recombination into an infected population, with the prediction that recombination will increase fitness for both infected and

cured lines of *T. kaykai*. Our results suggest there are significant costs associated with infection and absence of recombination. These results are discussed in terms of the evolutionary fitness of *Wolbachia*-infected populations.

97 - A biogeographic profile of the sand cockroach *Arenivaga floridensis* and its bearing on origin hypotheses for Florida scrub biota

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Florida scrub is a xeric ecosystem associated with the peninsula's sand ridges, whose intermittent Pliocene-Pleistocene isolation is considered key to scrub endemism. One scrub origin hypothesis posits endemics were sourced by the Pliocene dispersal of arid-adapted taxa from southwestern North America; a second invokes Pleistocene migration within eastern North America. Only one study has explicitly tested these competing hypotheses, supporting an eastern origin for certain scrub angiosperms. For further perspective, we conducted a genetic analysis of an endemic arthropod, the Florida sand cockroach (Arenivaga floridensis), with two aims: 1) to reconstruct its peninsular colonization and residence history; and 2) determine whether the roach's biogeographic profile favors either origin hypothesis. We sequenced the cox2 mitochondrial gene for 237 specimens as well as additional loci for a subset of Florida roaches and congeners. We identified three major lineages whose genetic differentiation and phylogeographic structure correspond with late Pliocene peninsula insularization, indicating Arenivaga was present and broadly distributed in Florida at that time. Stem and crown divergence estimates (6.36 Ma; 2.78 Ma) between A. floridensis and western sister taxa span a period of extensive eastward dispersal along an arid Gulf Coast corridor. These results yield a biogeographic profile consistent with the western origin hypothesis and complement residence age estimates of other endemics, favoring a Pliocene (or earlier) inception of the scrub ecosystem. We argue that eastern versus western hypotheses are not mutually exclusive; rather, a composite history of colonization involving disparate biotas better explains Florida scrub origins.

98 - Early Pleistocene ecosystem evolution and heterogeneity at East Turkana, northern Kenya as indicated by stable carbon and oxygen isotope data from mammalian enamel

Kayla Allen, David Patterson

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During the Early Pleistocene of eastern Africa, paleoenvironmental data suggest a shift from wooded-brushland environments to a grassland-dominated landscape more analogous to modern African ecosystems. In this study, we use a large compilation (n=2623) of carbon and oxygen isotope values of both fossil and modern eastern African mammals to investigate dietary evolution and ecosystem dynamics over the past 2 million years in eastern Africa. We find that although most taxa remain isotopically static early in this period (e.g., Reduncini, *Hippopotamus*), some taxa (e.g., *Equus*, Alcelaphini) become depleted in their carbon isotopic signature, which indicates an increased prevalence of C3 (i.e., trees and shrubs) vegetation in the diet. These ancient patterns are particularly interesting given that the diet of modern representatives of these taxa is dominated by C4 vegetation (i.e., grasses and sedges). As a case study, we use the isotope values collected from fossil mammals collected from East Turkana in northern Kenya to assess the degree of habitat heterogeneity during this period. We find that vegetation in this fossil ecosystem was highly variable across space, comparable to that of modern eastern African systems. This study indicates 1) a major restructuring in the African savanna ecosystem, which could be related to increased anthropogenic impacts and 2) both ancient and modern eastern African environments are highly heterogeneous across

space. Future studies should expand this dataset to fill important spatial and temporal gaps in the record.

99 - Role of *Calopteryx* Wing Pigmentation in Conspecific Recognition and Mate Choice

Melissa Encinias[1], Suzanne Allison[2], Idelle Cooper[1]

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Traditionally, sexually dimorphic traits are thought to evolve through elaboration of male traits, due to male competition or female choice. However, the role of females in sexual dimorphic evolution is often overlooked. In the *Calopteryx* damselfly genus, wing pigmentation is sexually dimorphic. Female damselflies of some species are known to prefer males with darker wing pigmentation. When geographic distribution of Calopteryx species overlap, misdirected mating between species may occur if females prefer darker-winged heterospecific males. Hybridization is generally expected to reduce fitness, so sexual selection may conflict with species recognition in this areas of sympatry. We are studying the traits under sexual selection and ecological selection in two North American damselfly species, *C. aequabilis* and *C. maculata*. Specifically, we ask whether the same trait of wing pigmentation is under selection for both functions. These species have a geographic distribution ranging from the northeastern United States to southeastern Canada, containing allopatric and sympatric populations. Sympatric *C. maculata* females show character displacement by having lighter wings than allopatric females, perhaps through selection for species recognition. We hypothesize that male wing pigmentation is under sexual selection, and the same trait in females is under selection for species recognition. We show preliminary data here and propose mate choice experiments to address this question during the summer of 2018.

100 - *Wolbachia infection frequency and evolution among mosquito (Culicidae) species*

Rebekah Williams, James E Russell

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Wolbachia bacterial infections among tropical mosquito species has been found to reduce the transmissibility of mosquito-vectored human diseases, such as dengue; raising the possibility of biological applications to decrease the spread of diseases. Understanding the frequency and basic biology of Wolbachia infections among mosquito species is an important step in this endeavor. We have collected mosquito samples from several sites across the metro Atlanta area and identified them to species using morphological keys and molecular DNA barcoding protocols for mitochondrial gene regions. Wolbachia infection status using a PCR protocol for a 16s ribosomal gene sequence specific for Wolbachia has been used to identify infected mosquito samples. Wolbachia 16s, MLST and mosquito mitochondrial and nuclear genes have been sequenced and analyzed for phylogenetic congruence. Preliminary results found a Wolbachia infection frequency of 0.33 for mosquito species sampled. Phylogenetic results suggested Wolbachia infections resulted in a mitochondrial selective sweep for Aedes albopictus, and disjunct placement of infected Culex mitochondrial sequences. The discordance of nuclear and cytoplasmic phylogenies for these mosquito species suggests an evolutionary impact of Wolbachia on infected mosquito mitochondrial genomes.

101 - Investigating Karyotype Evolution in the Genus *Sarracenia*.

Ryan Holland, Jeremy Rentsch

Francis Marion University, Florence, SC

Terrestrial pitcher plants of the southeastern United States have evolved to live in low nutrient soils by virtue of their ability to capture and digest prey in their modified leaves. Recent work

analyzing the transcriptomes of *S. psittacina* and *S. purpurea* seem to suggest a whole genome duplication event relatively recently in the genus. Given that these species are quite closely related, it remains unclear whether this event occurred in the ancestor of the genus or occurred more recently in the common ancestor of *S. psittacina* and *S. purpurea.* Further, it is quite common for polyploid plants to undergo large-scale genome reorganization and return to a state of being effectively diploid. Previous reports on *Sarracenia* karyotypes produced relatively simple drawings of chromosomes, and lacked the necessary information (*e.g.* banding patterns) that would allow us to identify interspecific homologies. These studies do, however, show a strong bias in favor of somatic cells in *Sarracenia* having 26 chromosomes; however multiple authors report a haploid chromosome count at only 12. Here, we investigate the karyotype evolution within the genus *Sarracenia*. We will karyotype a number of *Sarracenia* species (and subspecies) including: *S. alata*, *S. flava,* S. *leucophylla, S. psittacina, S. purpurea* subsp. *purpurea, S. purpurea* subsp. *venosa,* and *S. rubra.* We will apply a Giemsa stain to produce a G-banding pattern, which will help us identify interspecific homologies. These data should help us elucidate the timing of the whole genome duplication even in Sarracenia and the extent to which the group has returned to a functional state of diploidy.

102 - Patterns and Drivers of Niche Evolution in Liatris, a Rapid Radiation

Anthony Melton, Pamela Soltis, Douglas Soltis

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How organisms diversify across heterogeneous environments remains a major question in evolutionary biology. Niche divergence has been found to be a crucial component of this process, particularly in rapid radiations. The flowering plant *Liatris* (blazing star, Asteraceae) is an ideal clade to use as a model for investigating niche evolution in rapid radiations, as it comprises 37 species that occur in a diverse array of habitats and has likely diversified within the last million years. The genus also includes hybrids and polyploids, which affords the opportunity to investigate how these processes can affect niche evolution. My work aims to elucidate phylogenetic relationships and patterns of niche evolution within *Liatris*, and how different biological processes have shaped them. A preliminary phylogeny derived from matK sequence data has been constructed, but has provided little resolution. Thus, a target-enrichment approach will be utilized to acquire hundreds of single-copy nuclear loci. These data, in conjunction with off-target chloroplast loci, will be used in phylogenomic analyses. Chromosome counts and flow cytometry are being conducted to inform studies of hybridization and polyploid evolution. Publicly available ecological data and digitized herbaria records are being used to develop ecological niche models. The phylogeny and ecological niche models are being used to reconstruct the ancestral niche state to elucidate patterns of niche evolution. My preliminary analyses suggest that niche divergence has occurred, even among presumably closely related species. This work will increase our understanding of how these aspects of biology can affect speciation and niche evolution patterns within a group of closely related species, and will help elucidate how the diversity we see today may have arisen.

103 - Identifying the Molecular Components of Cold Nociception in *Drosophila melanogaster*

Kendyl Combs, Rachel Barborek, Susan Halsell

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Nociception refers to an organism's perception and reaction to noxious stimuli. While nociception is a beneficial behavioral response to harmful stimuli, humans suffer from chronic pain when pain signals abnormally persist months after any form of trauma, injury or infection. This study aims to better understand the molecular mechanisms of pain by researching the potential role of eight Drosophila Innexin gap junction proteins in cold nociception. These invertebrate proteins are evolutionarily similar to mammalian Connexins. To screen for a

possible role of the Innexin proteins in cold nociception signaling, the expression level of each protein is knocked down by cell-specific expression of innexin RNAi constructs in either all four classes of dendritic arborization sensory neurons (da neurons) or expression is knocked down in just the class III da neurons. Wild type third instar Drosophila larvae exhibit a characteristic "cringe" response when exposed to noxious cold. Larvae are placed on a cold plate, and their behavior is videotaped. Subsequently, the larval images are processed using Image J software to quantify the "percent cringe" value for statistical analysis. By comparing the percent cringe of the protein-lacking, experimental larvae to the wild type, the involvement of the knockdown protein in the cold nociceptive signaling pathway can be inferred. Controls utilizing Oregon-R wild type larvae (positive for wild type cringe response) and larvae in which tetanus toxin (TNTE; cringe inhibition control) is expressed specifically in da neurons will be described. To date, ogre, shaking-B, zero population growth, innexin 2, and innexin 3 have been tested. Down regulation of ogre, shaking-B, or innexin 3 in class III da neurons significantly inhibited cringing (Two-Tailed Fisher Exact Test). Assays are ongoing for the remaining three innexins, and also will be presented.

104 - SSIP1 is Required for SDG7-Mediated H3K36 Trimethylation in *Arabidopsis thaliana*

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Histone modifications in eukaryotic organisms are required for normal gene expression and development. In plants, methylation of histone H3 lysine 36 (H3K36me) is the most abundant histone modification within genic regions, but the least understood. Two partially redundant enzymes, SET DOMAIN GROUP 7 (SDG7) and SDG8, are responsible for the deposition and maintenance of H3K36 di- and trimethylation (H3K36me2/3) in *Arabidopsis thaliana*. Previous studies have shown that SDG8 is recruited by methylation of histone H3 lysine 4 (H3K4me). The mechanisms that target SDG7, however, remain unknown. Using in vivo pull-down and mass spectrometry assays, a PHD Zinc Finger protein (SDG SEVEN INTERACTING PROTEIN 1, SSIP1) was found to interact with SDG7, indicating that this protein could be responsible for targeting SDG7. ChIP-seq results revealed that *sdg7* and *ssip1* share the same patterns of H3K36me3 loss, indicating that SSIP1 is required for SDG7 function. Experiments to further characterize the SSIP1-SDG7 interaction and the function of SSIP1 are ongoing.

105 - Do Correlations Exist between Harm Avoidance, Risk Assessment, the STin2 polymorphism, and Marijuana Use in College Students

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Georgia Gwinnett College, Lawrenceville, GA

Harm avoidance (HA), one of the personality traits described in Cloninger's (1993) Temperament Character Inventory, is characterized by heightened apprehension, shyness, pessimism and tenseness in unfamiliar situations. *Cannabis,* popularly known as marijuana, is the most widely used semi-illicit substance in the United States. Marijuana use is more prevalent in young adults, and affects mental health particularly anxiety and depression. The serotonin pathway is linked to the harm avoidance temperament, particularly the STin2 polymorphism of the serotonin transporter gene (SLC6A4). This polymorphism is characterized as a variable number of tandem repeat (VNTR) polymorphism in intron 2 (STin2) that is either 9, 10 or 12 copies of a 16–17 bp sequence. There is a relationship between the STin2 polymorphism and different mental disorders including anxiety disorder and obsessive-compulsive disorder (OCD). This study focuses on identifying if correlations exist between HA, marijuana use, assessment of risk related to marijuana use, and the STin2 polymorphism in college students. Two hundred and one Georgia Gwinnett College students participated in this study by completing the Temperament and Character Inventory. Additionally, their DNA was

collected for genotyping, using buccal swabs. Preliminary data suggest no correlation between harm avoidance and the frequency of marijuana use, ($r=-0.028$, $p> 0.05$). As previously reported, significant correlations exists between the frequency of use and risk assessment ($r= -.392$, $p<0.01$). Furthermore, there is a significant difference in the average harm avoidance score for male and female ($p<0.01$), the mean for males being 12.19 and a standard deviation of 7.154, and the mean for females being 17.04 with a standard deviation of 7.273. We are currently genotyping the STin2 polymorphism and will report findings at the meeting.

106 - Using Maximum Likelihood Networks to Infer Reticulation Events Between Lineages in the Northern Dusky Salamander Species Complex

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Reproductive isolation is one of the hallmarks of speciation. The number of species in Dusky salamanders (Desmognathus) has been a difficult and contentious subject amongst biologists. The Northern Dusky salamander (Desmognathus fuscus) has at times been considered to contain three subspecies, although each of these are currently afforded full-species status. Recent studies have uncovered additional cryptic diversity within Northern Dusky salamanders, and the appropriate taxonomic treatment of this diversity is not resolved. Due to the low vagility of Dusky salamanders (Desmognathus), it is highly unlikely for large amounts of gene flow to occur amongst populations; however, in some areas, the cryptic lineages occur in close proximity of one another. These areas of contact provide the geographic context to enable gene flow or reticulation in these lineages. To better understand this species complex, we created Bayesian phylogenetic reconstructions of mitochondrial DNA sequence data and genomic data. The relationships presented in both types of data differ, and a plausible explanation for this is introgression between lineages. Gene trees reconstructed from 40 loci sampled from 30 populations were used to infer a species network in PhyloNet 3.6.1 under the maximum parsimony method. Inconsistencies occurred between runs, so to better resolve these, we expanded our dataset to include a total of 400 loci and then constructed a network under the maximum likelihood method.

107 - Salamander-leech Mania: A Cautionary Tale

Cayla Simmons, Tyler Brock, Emily Bewick, Jessica Wooten, Carlos Camp

Piedmont College, Demorest, GA

Published primers are useful and presumed to be taxon specific. Therefore, they are often utilized to ensure quality DNA sequences are generated from PCR products. Using such primers, we investigated possible coevolution between the leech *Placobdella biannulata* and its primary host, the salamander *Desmognathus quadramaculatus*. DNA was extracted from the tail clippings of salamanders and their corresponding leeches, which were induced to fall off by anesthetizing with MS222. Published primers were then used to amplify DNA segments from the mitochondrial genes 12S and CO1. These are variable markers that are often used in DNA barcoding to taxonomically categorize organisms. Following amplification, PCR products were sequenced, and the results received were unexpected. Of the twenty-eight initial leech extractions that were amplified with leech primers for CO1, twenty-seven were identified (BLAST) as *D. quadramaculatus*. A second batch of fifteen extractions was done on the initial samples, but this time the literature protocol was followed exactly by removing the oral suckers from each leech prior to DNA extraction. Fifteen leech extractions were then used to amplify both 12S and CO1. Eight 12S extractions resulted in *D. quadramaculatus* sequences, and 12 of the CO1 extractions returned *D. quadramaculatus* sequences. Further evaluation of the CO1 primers revealed that they were in one of the few highly conserved regions between

leeches and salamanders, and none of these issues were mentioned within the literature. As a result, there is a significant need for new primers that are specific to *P. biannulata* to eliminate this cross-amplification issue.

108 - Human Effects on Genetic Diversity in Two Cryptic, Parapatric Salamanders *(Eurycea* bislineata complex)

Jessica Smith, Andrew Duitsman, Keelan Passmore, Daniel Whitson, Emily Bewick, Carlos Camp

Piedmont College, Demorest, GA

Human impacts can have local and widespread effects over time. Human modification of landscapes can influence population structure and gene exchange. The parapatric salamanders *Eurycea cirrigera* and *E. wilderae* occur sympatrically in Hazel Creek in Habersham County, Georgia. A small tributary having both species on the campus of Piedmont College was isolated from the rest of the watershed by the construction of a 21-ha lake circa 1890. The College later constructed athletic fields in 1960 that separated the upland headwater of the stream from the swampy lowland developing from succession of the lake. The athletic fields functionally isolated the two species from each other with *E. wilderae* restricted to the headwater and *E. cirrigera* in the lowland habitat. We investigated the effect of isolation of both species on genetic diversity by examining the nuclear gene POMC. We found that both populations had reduced genetic diversity relative to allopatric populations as well as sympatric populations located elsewhere in the Hazel Creek watershed. The construction of the lake has apparently isolated both populations and exposed them to the purifying effects of genetic drift. In addition, the athletic fields may prevent any chance of introgression. Therefore, anthropogenic changes to the landscape have had significant impacts on gene exchange within and possibly between these species.

109 - Comparison of the Multiplex Primer Set to the P2/P8 Primer Set and the DNA Source used for the Molecular Sexing of Owls

Alana Jefferson

Queens University of Charlotte, Charlotte, NC

Raptors are sexually monomorphic, meaning there are no physical characteristics distinguishing male from female. Since little research has been done on raptors native to the southeastern part of the United States, this study was conducted to determine which primers were most successful in sexing raptors through molecular genetics, as well as whether DNA extracted from feathers could produce conclusive results. Local raptors were received from the Carolina Raptor Center. DNA was extracted from liver and feather samples obtained from birds sexed during necropsy. While the DNA concentrations obtained from the liver samples were greater than that of the feathers, both DNA sources produced reliable results. A multiplex primer set and the P2/P8 primer set were used to target the sex chromosomes during PCR. The PCR product produced using the P2/P8 primer set was then digested with the restriction enzyme *Hae III*, followed by gel electrophoresis. The P2/P8 primer set produced results consist with the sex determined upon necropsy for four owls, while the multiplex primer set was inconclusive. It was concluded that the P2/P8 primer set paired with a restriction digest produced consistent results in owls and that DNA extracted from feathers were able to produce sex-determining bands.

110 - Identifying Satellite Repeats in Grass Genomes

Claire Menard[1], William Nelsen[2], Matt Estep[3]

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Satellite repeats are highly abundant, non-coding sequences of DNA, ranging from 150 to 180 base pairs in length that are GC-rich. Additionally, these sequences are found in tandem arrays that span megabases of many plant genomes. It is thought that they may play a vital role in the formation of heterochromatin in centromeres and are also associated with telomeres, but their overall function in eukaryotic genomes is widely unknown. Although these sequences are highly repetitive, they are also fairly well conserved within species. However, they are highly variable between species providing some insight into how they evolve over many generations. Using a bioinformatic pipeline we identified unique satellite repeats in four different grass species closely relayed to maize (*Zea mays mays*). Once satellite repeats were identified we estimated the percent composition so that we could estimate their impact on genome size in the four grass genomes. Our ultimate goal is to develop molecular probes that can be used in cytological investigations to determine where these repeats are located in grass genomes. Visualization of these repeats within the centromere could provide insight into the dominance effect of genomes after hybridization or why one centromere is chosen over another.

111 - Development of microsatellite markers for diversity studies within the genus *Dicentra.*

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The genus *Dicentra* (Fumariaceae, Bernhardi) is a small clade of herbaceous plants containing seven species in North America and one species in eastern Asia. Three species; *D. eximia, D. cucullaria*, and *D. canadensis* exhibit a polyploid series in the Southern Appalachians, where *D. eximia* is a diploid (2N=16), *D. cucullaria* is a tetraploid (2N=32) and *D. canadensis* is an octoploid (2N=64). To examine genetic diversity and species boundaries within the polyploid series, microsatellite markers are being developed. DNA from *D. cucullaria* was sequenced on an illumina sequencer, resulting in 533,116 sequences. These sequences were searched for microsatellite motifs using MSATcommander software. We identified 10,717 microsatellite motifs within the sequence data and designed primers for 50 loci. Primer pairs were screened against seven DNA samples from *D.cucullaria* or *D. canadensis*. Seventeen of the fifty primer pairs successfully amplified a single locus based on 1% gel electrophoresis. These primers were used to fluorescently label PCR products for fine resolution genotyping on an ABI3730 sequencer. Chromatograms of the products were produced and analyzed, but we found scoring the multiple peaks of polyploids difficult. Therefore, we have included *D. eximia* (2N) to verify peak patterns and further refine the molecular markers.

112 - New genome size estimates for quillworts (*Isoetes*) and their application in species delimitation

Karina Noyola-Alonso[1], Viridiana Mandujano[1], Peter Schafran[2], Carmony Hartwig[1], Slavko Komarnytsky[3,4], Jay Bolin[1]

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The genus *Isoetes* is known for morphological convergence and a paucity of morphological characters for field identification. Like many other plant lineages, polyploidy, and reticulate evolution are important drivers of speciation in *Isoetes*. Thus, the chromosome complements

of *Isoetes* spp. are key attributes for species delimitation. By using a rapid DNA flow cytometry protocol, we generated C values, a measure of DNA quantity, for numerous diploid, tetraploid, hexaploid, and one octoploid *Isoetes* species. As expected we observed a significant positive correlation between C value and chromosome complement. These results indicate that DNA flow cytometry may prove a useful tool for routine *Isoetes* species identification, systematic work, and population-level surveys of *Isoetes* ploidy level.

113 - Cultivating quantitative skills in the next generation of scientists while building a phenotype library for knockout mutant plants.

April Bisner, Courtney Murren, Matt Rutter, Allan Strand

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Networked research provides students with the opportunity to obtain research experience, to interact with students and faculty from other institutions, and to contribute to a wider body of scientific knowledge. Here, I will discuss the methodologies of the unPAK (UNdergraduate Phenotyping of Arabidopsis Knockouts) project. unPAK is an expanding network of diverse institutions providing hands on scientific research experience by means of internships and in classrooms through Course Based Undergraduate Research Experiences (CUREs). Students measure quantitative fitness related phenotypes of the model plant Arabidopsis thaliana in either control or manipulated environments in order to uncover the connection between phenotype and genotype. We take advantage of a set of over 48,000 mutant lines in the same genetic background (Salk homozygote T-DNA insertion mutant lines). We begin by bulking seed (farming) and screen each line for number of T-DNA insertions. Farmed seed from putative single insert lines and a set of natural accessions (phytometers), are distributed to participating institutions. We employ phytometers to standardize environmental differences among phenotypic assays. A set of standardized protocols is followed by each institution. However the experimental design is adaptable to growing facility size, class size, number of student interns, and the specific interests of the professor and students. Results from each study are made available on a searchable database on the unPAK website thus providing students with the opportunity to produce biological data that is available to the plant science community.

114 - Characterizing the Role of Hemocytes, Organs, and Tissues in the Clearance of Bacteria from Lobster Hemolymph

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Roanoke College, Salem, VA

The American lobster, *Homarus americanus*, mounts a rapid immune response to an acute bacterial infection, which rapidly (within 30-45 minutes) clears bacteria from the circulation. Inversely proportional trends in hemolymph hemocyte and bacterial cell numbers indicate that hemocytes play a critical and direct role in the clearance process. It is, however, unclear if circulating hemocytes are responsible for the bulk of the clearance process, or if bacteria are sequestered in tissues and organs in addition to being engulfed by circulating hemocytes, or if there are additional complexities in the clearance process. To characterize this immune response and determine the role of organs and tissues in the process, we employed two methods: 1) whole organ culture to determine the number of culturable bacteria present as colony forming units (CFUs); and 2) qPCR to determine the total number of bacteria (both culturable and non-culturable) present in a tissue or organ. The qPCR data should allow us to avoid underestimating the magnitude of the role a tissue or organ plays in the clearance process. Prior literature suggests that the gills may play a primary role in the clearance process, but our data indicate that other tissues and organs, such as the heart and antennal glands, may plan an even more dominant role in the immune response effort.

115 - Prevalence and infection intensity of fungal pathogen *Batrachochytrium dendrobatidis* in the eastern newt (*Notophthalmus viridescens)* in relation to seasonal change

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Batrachochytrium dendrobatidis (*Bd*) is a fungal pathogen that causes chytridiomycosis, an emerging infectious disease responsible for worldwide declines of amphibian species. In the eastern United States, *Bd* is widespread, but occurs sporadically across the landscape. For most species in this region, the population level impact of *Bd* is unknown and is difficult to measure without long-term studies. The objective of this study was to set up a long-term monitoring project to study the population level impact of *Bd* on the eastern newt (*Notophthalmus viridescens*) and to determine how seasonal changes affect host-pathogen dynamics. The eastern newt is highly susceptible to *Bd* infections, but the effects of chytridiomycosis on this species is unknown. To complete these objectives, 25 eastern newts were collected and sampled monthly at a pond in Campbell County, Virginia. To sample for *Bd*, each newt was individually collected and its skin was swabbed with a sterile rayon swab. The sex, snout-vent length, and mass were recorded for each newt. Environmental variables such as air and water temperature and recent precipitation history were also collected during each sampling. DNA was extracted from swabs using the Qiagen DNeasy Blood & Tissue Kit. DNA was amplified with *Bd*-specific quantitative PCR (qPCR) assays to quantify the number of *Bd* sequence copies present on each individual (infection intensity). Preliminary results show that in January 2017 a high proportion of the population (88%) was infected with *Bd* with a relatively high average infection intensity (1151 *Bd* sequence copies per newt). Based on the biology of *Bd* in culture and previous studies, it is expected that *Bd* prevalence and infection intensity will be higher during cooler months and lower during warmer months. Continued monitoring of this population will allow us to determine the population-level impact of chytridiomycosis on the eastern newt.

116 - Characterization of the interactions between symbiotic microbes of the salamander *Desmognathus fuscus* and the fungal pathogens *Batrachochytrium dendrobatidis* and *B. salamandrivorans*

Catherine Twomey, Micah Burnham, Casey Mahoney, Matthew Becker

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In recent years, amphibian populations worldwide have seen unprecedented declines. These declines have been closely associated with a dramatic increase in incidence of the disease chytridiomycosis. This disease is caused by two fungal pathogens, *Batrachochytrium dendrobatidis* (*Bd*) and *B. salamandrivorans* (*Bsal*), which infect the skin of many amphibian species. *Bd* is a very unique pathogen because it infects organisms across three different orders of vertebrates (Anura, Caudata, and Gymnophiona). *Bd* is present in amphibian species of the southeastern United States, with a widespread distribution and low levels of occurrence, suggesting that this fungus is endemic. *Bsal* has dramatically affected salamander populations in some European countries and has not been detected in the United States despite intense sampling. There is great concern the pathogen could spread to the US through commercial trade. Previous research suggests that the symbiotic microbial community associated with the skin of some amphibians protects them from *Bd* and *Bsal*. This study seeks to characterize the microbial communities of the dusky salamander, *Desmognathus fuscus*, and to identify interactions between host symbiotic microbes and the pathogens *Bd* and *Bsal*. This will be completed by culturing the cutaneous bacteria of *D. fuscus* and identifying these isolates through Sanger sequencing of the 16S ribosomal RNA gene. These same isolates will be co-cultured with *Bd* and *Bsal* to determine if they inhibit or promote the growth of the fungi *in vitro*. *Desmognathus fuscus* individuals will also be tested for *Bd* and *Bsal* through skin swabs and

quantitative PCR assays. We expect that the resident microbes isolated from *D. fuscus* will inhibit the growth of *Bd* and *Bsal*. Antifungal isolates could potentially be used as probiotics to mitigate chytridiomycosis in susceptible amphibian species.

117 - Characterization of the Peaks of Otter Salamander Microbiome as an Innate Defense against Emerging Infectious Diseases

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Recent global amphibian population decreases have prompted inquiry into possible causes, and scientists have implicated the fungal pathogens *Batrachochytrium dendrobatidis* (*Bd*) and *Batrachochytrium salamandrivorans* (*Bsal*) as key causes. These fungi infect the skin of many amphibian species which can result in the pathogenesis of chytridiomycosis, a fatal disease. While some amphibian populations have been shown to be resistant to chytridiomycosis, others are susceptible to the disease; resistance against *Bd* infection has been linked to the production of anti-fungal biomolecules by symbiotic cutaneous bacteria. The Peaks of Otter salamander (*Plethodon hubrichti*) is a terrestrial species endemic to the Peaks of Otter within the Blue Ridge Mountains of Virginia. We sought to characterize the microbiome of the *P. hubrichti* to better understand host-symbiont-pathogen interactions. *P. hubrichti* individuals (N=15) were captured using gloves and rinsed with sterile water to remove transient microbes. The skin of each specimen was swabbed to collect microbial cells. Cells were transferred to R2A agar plates and incubated at room temperature. Bacterial and fungal colonies were examined for morphology and were isolated by streaking. The DNA of pure cultures was extracted and subsequent 16S rRNA Sanger sequencing will identify the species of each isolate. Co-culture assays will be employed to test the *in vitro* efficacy of each bacteria in inhibiting the growth of *Bd*. Additionally, the presence of *Bd* and *Bsal* will be quantified using distinct skin swabs whose DNA will be extracted and quantified in species-specific qPCR assays. It is suspected that the healthy microbiome of *P. hubrichti* will confer some anti-fungal properties, and this finding will prompt exploration into possible bioaugmentation strategies for conservation purposes.

118 - Extended Spectrum Beta Lactamase Producing Enterobacteriaceae in North Georgia Water

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Extended-spectrum beta-lactamases (ESBLs) are enzymes that are capable of degrading frequently used antibiotics such as, penicillin and cephalosporin. Organisms that produce these enzymes are therefore multi-drug resistant. ESBLs are commonly produced by the *Enterobacteriaceae* group of bacteria that are part of normal gut flora. Since first identified in 1893, ESBLs have become increasingly prevalent because ESBL enzymes are plasmid mediated, thus their resistant genes are easily transferred between bacteria via horizontal and vertical gene transmission. Currently, ESBLs pose a significant health threat due to their ability to cause a multitude of difficult to treat infections and are one of the leading causes of death world-wide. As of yet, there is no data on prevalence of ESBL-producing Enterobacteriaceae in North Georgia water sources. Flat creak is located in North Georgia and runs directly into Lake Lanier, which is a main source of drinking water for the Atlanta area as well as a popular spot for water recreation. We obtained efferent and afferent water samples from Flat Creek Water Reclamation Center in Hall County Georgia. These water samples were filtered, grown in an enrichment media and plated on selective media that yielded the isolation of ESBL-producing *Enterobacteriaceae*. We found ESBL producing enterobacteria in every sample we tested. Further identification methods revealed the presence of ESBL producing *Kebsiella*

pneumoniae, *Kebsiella oxytoca, Enterobacter cloacae*, *Citrobacter freundii* and *Escherichia coli*. Following identification, disk diffusion method was used to test susceptibility of the isolates to several commonly used antibiotics. Lastly, DNA was extracted from the isolates to confirm the presence of *bla* genes that encode for ESBLs.

119 - Exogenous polyunsaturated fatty acids (PUFAs) promote changes in growth, phospholipid composition, membrane permeability and virulence phenotypes in *Escherichia coli*

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As a model organism, *Escherichia coli* has been the prime subject of numerous research efforts aimed at deciphering bacterial physiology and pathogenesis. Despite extensive research, *E. coli* has received little to no attention regarding its capacity to remodel its phospholipid membrane with exogenous fatty acids. Recent studies have documented the ability for some bacteria, such as *Vibrio* and *Acinetobacter* species, to assimilate exogenous fatty acids into their membrane phospholipids. Therefore, the current study was performed to determine whether *E. coli* can remodel its membrane following exposure to a range of exogenous polyunsaturated fatty acids (PUFAs). Furthermore, we hypothesized that PUFAs would influence phenotypes associated with growth and virulence. Thin Layer Chromatography (TLC) analysis of extracted phospholipids following exposure to individual PUFAs provides qualitative data supporting fatty acid incorporation. Membrane permeability assays were performed using Crystal violet (CV) and ethidium bromide (EtBr). Notably, *E. coli* exposed to docosahexaenoic acid (22:6) or arachidonic acid (20:4) took up approximately 35% or 60% more CV than the control sample, respectively. All PUFA-exposed *E. coli* cultures demonstrated higher uptake of EtBr than the control sample, suggesting that every fatty acid tested increased membrane permeability. Growth curves indicated elevated growth when fatty acids are available; however, only linoleic acid (18:2) supported growth when supplied as the sole carbon source. An assay for biofilm formation revealed that α-linolenic acid (18:3α), γ-linolenic acid (18:3γ), 20:4, and 22:6 significantly ($p < 0.001$) increased biofilm production in *E. coli*. Strikingly, 18:3γ and 20:4 tripled biofilm formation when compared to the control sample. Extracted phospholipids are currently being examined by ultra performance liquid chromatography - mass spectrometry (UPLC-MS) to confirm assimilation of exogenous fatty acids into bacterial phospholipids. Other experiments expected to be presented include motility assays and minimum inhibitory concentrations (MIC) assays using membrane-active cyclic peptide antibiotics.

120 - Impacts of poultry rearing facilities on the abundance and genetic diversity of *Escherichia coli* in stream waters of the South Carolina Piedmont

Virginia Britt, Min-Ken Liao, Garrett Elmore, Greg Lewis

Furman University, Greenville, SC

Surface runoff and groundwater often transport nutrients and fecal bacteria from agricultural land into bodies of water. Our study focused on how poultry rearing facilities (PRFs) in South Carolina's Piedmont region affect the concentrations and genetic diversity of fecal indicator bacteria in stream water. During June-August 2017, we collected water samples from nine streams with PRFs upstream and nine streams without PRFs upstream in the upper Savannah River Basin. In all watersheds, land cover was primarily mixtures of forest and pasture. For each water sample, we measured the concentrations of total coliforms, Escherichia coli, and Enterococcus spp. using IDEXX methods. The streams with PRFs upstream had significantly higher mean concentrations of Enterococcus, but there were no significant differences between the concentrations of total coliforms or E. coli in streams with and without PRFs

upstream. We also isolated and identified 437 E. coli from the water samples. Multiplex PCR, with three sets of primers, was used to categorize each E. coli isolate into one of four main ECOR phylogenetic groups: A, B1, B2, and D. Previous research has found an association between ECOR type A and poultry. We found that ECOR profiles of E. coli populations downstream of PRFs were significantly different from those upstream. At sites without PRFs upstream, isolates were 16.3% group A, 36.6% group B1, 22.7% group B2, and 24.4% group D. For sites downstream of PRFs, isolates were 10.6% group A, 45.6% group B1, 13.6% group B2, and 30.2% group D. Overall, our results suggest that, although PRFs did not seem to affect the overall concentrations of E. coli in stream water, they did appear to influence the genetic diversity of E. coli.

121 - Impacts of Poultry Rearing Facilities on the Abundance of Total and Antibiotic-Resistant Heterotrophic Bacteria in Streams of the South Carolina Piedmont

Garrett Elmore, Virginia Britt, Min-Ken Liao, Greg Lewis

Furman University, Greenville, SC

The proliferation of antibiotic-resistant bacteria in the environment is a growing concern. Livestock, including poultry, are thought to be a major source of antibiotic-resistant bacteria in soil and water. The goal of our research was to investigate the potential impact of poultry rearing facilities (PRFs) on the abundance of total heterotrophic bacteria, including antibiotic-resistant heterotrophs, in streams in the Piedmont region of South Carolina. During June-August 2017, we collected water samples from 22 locations in 13 stream drainages in the upper Savannah River Basin. Concentrations of total heterotrophic bacteria were significantly higher downstream of PRFs than in streams without PRFs, but concentrations of bacteria resistant to 20 µg/mL tetracycline (Tn) did not differ significantly. We also isolated 221 Tn (20 µg/mL)-resistant bacteria from multiple locations within one stream drainage and tested their susceptibility against varying doses of ampicillin (Ap), kanamycin (Kn), and Tn. As a whole, the bacteria were 82%, 62%, 52%, and 14% resistant to 100 µg/mL of Tn and Ap, 50 and 100 µg/mL Kn and Tn, 640 µg/mL Tn, and 1280 µg/mL Tn, respectively. However, the highest levels of resistance to Tn were found upstream, rather than downstream, of a PRF. The 16S rRNA genes of these 221 isolates were amplified for restriction enzyme digest (HinP I and Msp I) analysis. However, there was no apparent difference between the RFLP patterns of bacterial populations in streams with and without upstream PRFs. In conclusion, PRFs appear to increase concentrations of total heterotrophic bacteria but not antibiotic-resistant heterotrophs in stream water. Bacterial resistance to high concentrations of Tn in the headwaters of one stream may be due influence of pasture and/or an upstream residential area.

122 - Effects of Fluoride Varnish and Sucrose on Cell Viability, pH, and Biofilm Formation of *Streptococcus mutans*

Rachel Pearson, Avianna Cliatt, Laronsia Cross, Joshua Hill, Joseph Gibson, Tevaris Haley, John Hetzel, Andrew Kumar, Elianna Largeman, Jennifer McMillion, Ekta Parab, Austin Strellner, Julie Wilson, Lauren King

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Introduction: *Streptococcus mutans* is a commensal of the human oral cavity and has been shown to be the primary cause of dental carries, the most common oral disease in children and adults. Dental caries has been linked to diets high in sucrose, most likely due to the primary byproduct of sugar metabolism by *S. mutans* being lactic acid. The bacteria proliferate and form biofilms on tooth surfaces, and subsequent accumulation of lactic acid causes the pH to decrease leading to erosion of the enamel and decay of the tooth. To combat this, Fluoride is commonly used as a treatment to rebuild the enamel of the teeth and may protect against decay and dental plaque. **Methods:** Cell viability of *Streptococcus mutans* in the presence of

sucrose, dextrose, and fluoride was tested. Biofilm formation of *Streptococcus mutans* on three different substrates was assessed in the presence or absence of 5% fluoride varnish, and pH changes induced by fermentation of sucrose, dextrose, or fluoride were measured. **Results:** Fluoride did not affect cell viability of *S. mutans*, but did decrease biofilm deposition and increase the pH of biofilm cultures. Cell viability was comparable in the presence of glucose or sucrose, but sucrose fermentation produced more acid as a byproduct than glucose. **Conclusions:** Fluoride may be an effective dental treatment regimen not only due to its remineralization properties, but also by increasing the pH of saliva and decreasing biofilm formation by *S. mutans* on surfaces. In order to prevent dental caries, glucose may be safer for consumption than sucrose. Good hygiene, a low sucrose-diet, and the use of fluoride seem to be useful practices in combatting dental plaque that could lead to dental caries.

123 - Determining the Antimicrobial Effects of Perillaldehyde

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Perillaldehyde is an essential oil used in perfumes and as a food additive for flavoring. Current literature shows that perillaldehyde has antibacterial properties, particularly against respiratory pathogens. However, no research has been performed regarding the effects of perillaldehyde on gastrointestinal pathogens. The goal of this project is to determine if perillaldehyde is effective against Escherichia coli, Salmonella typhimurium, and Lactobacillus acidophilus, inhabitants of the colon, and Helicobacter pylori, which flourishes in the stomach. If perillaldehyde survives stomach acidity and is active against potential pathogens, it could serve as an alternative antimicrobial treatment. Assessing its impact on Lactobacillus acidophilus growth could indicate its usefulness on treating pathogens while not disturbing beneficial members of the gut flora. To determine the efficacy of perillaldehyde against L. acidophilus, E. coli, and S. typhimurium, the broth dilution assay was performed in accordance with the Clinical Laboratory Standards Institute with modification for emulsifying essential oils. Each species was inoculated into brucella broth with 0.2% Tween 20 and various concentrations of perillaldehyde ranging from 0.1% to 5%. They were incubated for 24 hours at 37°C and compared to a positive control (without perillaldehyde) and a negative control (without bacteria). Standard plate counts were performed to assess the viability from each test group. It was found that 0.15% perillaldehyde is bactericidal against E. coli and S. typhimurium; at this concentration perillaldehyde killed the bacterial cells as opposed to inhibiting their growth. Testing the effects of perillaldehyde on H. pylori may provide further evidence of its potential in combating gastrointestinal pathogens.

124 - Cherokee Indian Plants Native to Anderson County, SC: An in vitro antibiotic assay of various medicinal plants

James Duduit, Thomas Kozel, Dorota Abramovitch, Frank Norris

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Native North American plants have been largely ignored by modern pharmaceutical researchers. Anderson County, South Carolina occupies what, until 1777, was Cherokee tribal land. Much has been written, with only anecdotal evidence, on medicinal Cherokee plants regarding their pharmacological uses. Seven common and uncommonly known plants used by the Cherokee as antiseptics and dermatological aids were tested for potential antibiotic efficacy. Techniques include: broth microdilution, agar disc diffusion, thin-layer chromatography and bioautography. Combined, these assays provide a quantitative and qualitative estimate of potential antibiotic activity *in vitro*. 6mm discs were used for diffusing plant extracts onto a lawn of either *Escherichia coli* or *Staphylococcus aureus*. A rather unassuming species of the Asteraceae family, *Arnoglossum atriplicifolium*, has proven

successful inhibiting growth primarily of *S. aureus*. The average zone of inhibition for flower and stem extracts of *A. atriplicifolium* ranged from 9mm at 0.25mg to 13mm at 0.75mg concentration. Further analysis of plant extracts was performed using GC-MS to determine chemical structures. Ongoing efforts compare fresh extracts against extracts of dried material and the effectiveness of extraction by solvents of differing polarity. Each plant selected for examination has been pressed with the collection site marked by GPS. This helps ensure taxonomic validity as well as allowing for further collection or study at a later date.

125 - Identification of Genes Involved in Fatty Acid-Mediated Chemotaxis in *Vibrio cholerae*

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Chemotaxis in bacteria is a vital mechanism that involves an organism's ability to respond to chemical signals in its environment. Three physiologically relevant fatty acids were chosen to test the hypothesis that they act as signaling molecules that trigger motility in *Vibrio cholerae*: linoleic acid (18:2), arachidonic acid (20:4), and docosahexaenoic acid (22:6). Each caused an upregulation or downregulation in motility of *Vibrio cholerae* by ≅20%. These three fatty acids are significant because they occur in environments where *V. cholerae* is known to thrive. 18:2 and 20:4 are found in human hosts during bacterial infection, while 22:6 is widespread among aquatic life associated with *Vibrio.* Genes encoding methyl-accepting chemotaxis proteins (MCPs) were targeted using a non-redundant *V. cholerae* transposon mutant library. Experiments with these genes isolated 8 candidates that were used for further investigation via motility assays consisting of a marine broth (0.3% agar). Several of these mutants exhibited motility indicative of involvement in the recognition and locomotive response to exogenous fatty acids. For example, 18:2 caused a >50% downregulation of motility of VC0176 as well as causing an upregulation of motility for other mutants such as VCA1069. VCA1405 experienced a 58% downregulation in the presence of 20:4, while VCA0864 and VCA0840 showed no change when grown in agar containing 18:2 and 20:4 respectively. Interestingly, VCA0864 is part of an operon already known to be involved in fatty acid liberation from phosphatidylcholine. This data uncovers several genes that may play a role chemotactic response to exogenous fatty acids in *V. cholerae.* Further examination of *V. cholerae* mutants will aid in discovery of the chemotaxis signaling pathways regulated by these fatty acids.

126 - Characterization of Bacteria from Distinct Environments with Antimicrobial Activity Against ESKAPE Pathogens

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The increase of incurable infections in healthcare institutions correlates to the continual rise of antibiotic-resistant pathogens, known as ESKAPE pathogens. As part of recent crowdsourcing efforts, students around the globe have cultured bacteria from local ecosystems to find novel, antibiotic-producing microbes in response to the threat of resistance. Southeastern North Carolina retains many diverse habitats from the pine forests to wetlands for isolating unique bacteria. Six different species were isolated from red anthill loamy soil, clay and loamy lakeshore soil, and the leaves of an Indian Hawthorn bush. These isolates were identified with test-bacteria overlays where zones of inhibition were present. The isolates demonstrated inhibition of test bacteria and one or more ESKAPE pathogens in cross-streak tests and disk diffusion assays. Gram staining was used for physical characterization of shape and cell wall thickness. Species were identified by 16S rRNA sequencing with BLAST analysis and Biolog phenotyping. A literature search revealed there was little information collected on the antimicrobial characteristics of these isolates. One of the most unique isolates, Pseudomonas koreensis, inhibited three ESKAPE pathogens: Klebsiella pneumoniae, Escherichia coli, and

Staphylococcus aureus. This bacterium was analyzed through chemical techniques ranging from metabolomics profiling to mass spectrometry. Currently, C18 solid phase extraction column chromatography is being performed to fractionate by the polarity of antimicrobial compounds from media components. Future experiments include reverse phase HPLC to purify the antimicrobial compound and CNMR to determine skeletal structure. Discovery of these compounds could help to formulate antibiotics for human use to slow the impact of antibiotic-resistant pathogens as an alternative to overused antibiotics.

127 - Molecular monitoring of methicillin-resistant Staphylococcus aureus (MRSA) in a hospital setting: Correlative study of patient and environmental isolates

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University of Tennessee at Chattanooga, Chattanooga, TN

Methicillin resistant *Staphylococcus aureus*, (MRSA) is a pathogenic bacterium that poses a serious risk in healthcare settings. MRSA can be characterized by a genetic element, known as staphylococcal cassette chromosome, which harbors the gene responsible for methicillin resistance, *mecA*. MRSA can be classified into two categories: community acquired, CA, and hospital acquired, HA. *S. aureus* strains represent a major health concern due to their prevalence in healthcare facilities and their rapidly evolving antibiotic resistance. The current study investigated the association between MRSA isolates obtained from patients and from the intensive care units in a local hospital. Among the bacteria isolated from the neonatal and pediatric intensive care units were *Staphylococcus aureus, Staphylococcus epidermidis, Escherichia coli,* and members of the *Micrococcus* and *Bacillus* genera. MRSA isolates were confirmed by a combination of mannitol salt agar, CHROM agar, and antibiotic disc diffusion. Genomic DNA was extracted from the MRSA isolates followed by multiplex PCR to differentiate between CA and HA. We utilized nine genomic markers to identify the *mecA* gene and differentiate the types of 13 patient samples and 8 environmental samples. In patient samples types II (HA) and IVd (CA) were confirmed. In environmental samples types III (HA), IVa (CA), and V (CA) were confirmed. Both patient and environmental samples expressed the *mecA* gene indicative of MRSA. The only correlative genomic marker between patient and environmental samples was the *mecA* gene; however, several isolates possessed *mecA* but did not match any of the types tested. Ongoing research involves the examination of over 50 more MRSA isolates, allowing further molecular characterization and determination of MRSA exchange in a healthcare setting.

128 - Molecular and Microbiological Analysis of Yeast Samples Isolated from West Tennessee.

Caitlyn McClain, Kevin Pitz

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The purpose of our research was to collect, culture, isolate, and identify naturally-occurring, wild yeast strains. Our genera of interest, *Saccharomyces* and *Brettanomyces,* are commonly used to commercially brew beer. Yeast strains were isolated from insects collected in Weakley and Obion counties in west Tennessee, since insects are known to carry organisms belonging to our selected genera. Seven isolates were obtained from these samples. PCR was used to amplify the ITS (Internal Transcribed Spacer) region (rRNA) of each sample. The PCR products were then analyzed by gel electrophoresis. GenBank was used to identify our samples to the levels of genus, species, and strain, or to the lowest taxonomic level possible. Herein, we present the results of the microbiological and molecular studies of these yeast samples.

129 - The Isolation and Characterization of Antimicrobial Compounds from Bacteria Isolated in Sediments of the Cape Fear River

Kristen Adams

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The discovery of antibiotic metabolites from marine resources has proven to be a new source for novel antibiotics used to treat bacterial infections. Culturing marine bacteria on media similar to their natural environment could result in more diverse isolates than those grown on traditional media. In this study, soil samples were taken from islands in the Cape Fear River, diluted and cultured on Marine agar 2216 and ISP-2 media. After culturing, samples were tested for antibiotic producers via a TSB overlay inoculated with *Staphylococcus epidermidis*. Isolate S5KI-3 (determined to be closely related to *Lysinibacillus*, through 16S rRNA sequencing with BLAST analysis and Biolog phenotypic assay, showed inhibition against *Acinetobacter calcoaceticus*, a gram-negative ESKAPE pathogen surrogate. S5KI-3 was cultured in broth and ethyl acetate extraction was used to concentrate the cell-free antibiotic. Using disk diffusion, the extracted antibiotic was tested against other ESKAPE pathogens. Column chromatography will be used to purify the active antimicrobial compound(s) by separating its components based on their polarity. This allows for further testing to determine the compound that is inhibiting microbial growth. The production of biologically active compounds from bacteria found in local marine sediments is a good indicator of the potential marine organisms can contribute to the need for novel antibiotics.

130 - The Role of Electron Bifurcation in Cellulose Degradation and Hydrogen Production in *Ruminococcus albus*

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Though cellulose is the most common polymer on earth and an important component of plant cell walls, it is very difficult to break down. When oxygen is lacking, anaerobic bacteria degrade cellulose through fermentation. For example, *Ruminococcus albus* uses a fermentative pathway to degrade cellulose and supply its cow host with nutrients. Under anaerobic conditions, hydrogen gas is a key metabolite and serves as an electron sink for carbohydrate metabolism. One pathway of hydrogen production is through electron bifurcation, a recently recognized third mechanism of biological energy conservation. Bifurcation reactions are characterized by having two electron donors with different energy potentials and a single electron acceptor, or the reverse. In *R. albus* bifurcating hydrogenase enzyme uses electrons from two cellular electron carriers in the sugar degradation pathway, NADH and ferredoxin, to produce hydrogen gas. Bifurcation allows the organism to maximize ATP formation, but proceeds close to the thermodynamically favorable limit. If hydrogen levels increase, hydrogen production through bifurcation becomes inhibited, and other pathways such as ethanol fermentation dominate. Cultures of *R. albus* were incubated for two weeks with chromatography paper as the cellulose source. Growth of cultures on cellulose was determined visually and by measuring metabolites. Hydrogen metabolism was followed by comparing the ratios of acetate, ethanol and hydrogen production. Hydrogen formation solely through bifurcation does not produce ethanol and yields hydrogen to acetate in a 2 to 1 ratio, while the ethanol pathway produces less hydrogen. Cultures initially produced higher rates of acetate, but ethanol production increased later in growth. These results suggest that the bifurcation pathway is not prominent in the degradation of cellulose and only is important at the beginning of growth. In addition, *R. albus* can adjust its metabolism to cope with thermodynamic limitations by shifting to ethanol fermentation to continue cellulose degradation.

131 - Bacterial Associates within the Gastrointestinal tract of the Coosa Darter *(Etheostoma coosae)*

Benjie G. Blair[1], Chris Murdock[1], Mark Meade[2], Chris Steed[3], Robert C. Watson[4], Matthew Fields[5]

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Many studies have demonstrated that microbes in the gastrointestinal (GI) tract are of high importance for the health of the host. However, few studies have focused on the Coosa Darter (*Etheostoma coosae*). In this study, Roche 454 pyrosequencing was applied to a pooled set of different 16S rRNA gene amplicons obtained from GI content of *E. coosae* to build an initial snapshot of microbiota diversity. This fish is found in a unique Northeast Alabama watershed and is related to a number of endangered species. Compared to culture-dependent investigation, this study reveals an impressive diversity of the microbial flora. The results presented here indicate that the major groups present were members of the phyla Proteobacteria, Firmicutes, and Verrucomicrobia. Conversely, the phyla Fusobacteria and Nitrospira were less common in these samples. The most prevalent genus represented was Tetragenococcus, a known fermenter, had 174 sequences of 1467 total for the sample. Many of these bacteria might be of high physiological relevance for *E. coosae* based on diet and may serve as a template for comparisons to other endangered fish species. It may also serve as a baseline to compare to fish isolated from contaminated streams, which may affect the health and microflora composition in these environments.

132 - Are *Vibrio vulnificus* in Oysters from the Timucuan Preserve Pathogenic?

Janel Clarisse Palomo

Jacksonville University, Jacksonville, FL

Vibrio vulnificus are potentially pathogenic bacteria that reside in temperate and tropical water with a salinity range of 5-25 ppt. These bacteria infect people through open cuts or wounds or the consumption of raw shellfish. Infection causes food or blood poisoning and occasionally results in amputations and deaths. This project seeks to isolate *V. vulnificus* from Florida's Timucuan Preserve, differentiate between pathogenic and non-pathogenic strains, and determine if there is a correlation between *V. vulnificus* concentrations and water parameters. Water and oyster samples were collected from the St. Johns River and a tributary, Sisters Creek, and isolated on refined cellobiose-polymyxin B-colistin (CPC+) agar, a selective and differential media. Bacteria from samples were then identified with matrix-assisted-laser-desorption-ionization time-of-flight (MALDI-TOF) mass spectrometry. The presence of bacterial capsules and the hemolytic ability of the isolates are being investigated to determine pathogenicity. Afterward, the growth of *V. vulnificus* at different temperatures and salinity levels will be examined.

133 - Using *Microbacterium foliorum* as a Host for the Isolation and Subsequent Annotation of a Novel Bacteriophage Genome

Hallie Smith, Victoria Frost, Kristi Westover

Winthrop University, Rock Hill, SC

Bacteriophages are viruses that inject their genome into specific bacterial hosts in order to replicate. As members of the Howard Hughes Medical Institute's SEA-PHAGES (Science Education Alliance – Phage Hunters Advancing Genomics and Evolutionary Science) program, freshman students at Winthrop University have previously isolated 21 novel phages from local

soil using the host bacterial strain *Mycobacteria smegmatis.* This semester the host bacterial strain *Microbacterium foliorum* was piloted in order to potentially increase the collection and knowledge of the diversity of actinobacteriophage that exist in the Rock Hill area. The novel phage Scamander was isolated directly from a locally collected soil sample. The subsequent purification and amplification protocols entailed multiple plaque assays which made use of techniques such as picking a plaque from a plate and various dilutions of phage lysate in order to obtain a pure phage sample with a high titer. Transmission electron microscopy showed that the phage has a long, flexible tail which is characteristic of the siphoviridae morphotype. Phage DNA was extracted and the genome was sequenced by the Pittsburgh Bacteriophage Institute. Annotation of the genome is in progress and the following programs are being used to determine specific gene data: protein blasts from PhagesDB, HHPred, and NCBI; gene start-site calling programs such as Starterator, GeneMaster, and Glimmer; and the genome comparison maps on Phamerator. When complete, the annotated genome will reveal the function of certain genes while also serving as a comparison for other existing and, as yet, undiscovered *Microbacterium* phages. The increasing database of bacteriophages and the characteristics of each phage helps to expand our understanding of the genomic diversity of viruses, particularly those that infect bacterial hosts in the phylum Actinobacteria.

135 - Comparison of antibacterial effect between *Hydrastis canadensis* extract and the alkaloid Berberine

Luke Scott

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It is argued that herbal medicines are effective due to the action of multiple constituents working together. Goldenseal (*Hydrastis canadensis*) is a widely used herbal medicine that may derive its effectiveness from the action of multiple synergistic compounds. Berberine, a secondary metabolite of Goldenseal, has been shown to possess antibiotic properties. However, preliminary studies have suggested that whole root extracts of Goldenseal may have a greater antibiotic effect than berberine alone. This may be due to efflux pump inhibition by unknown compounds in Goldenseal. In an effort to further characterize these possible synergistic compounds, antibiotic effect was tested via Minimum Inhibitory Concentration (MIC) assays. MIC's were obtained for pure berberine and whole root alcoholic Goldenseal extract. Goldenseal whole root extract appears to have a greater antibiotic effect than pure berberine, as evidence by a lower minimum inhibitory concentration. This result is congruent with the hypothesis that additional factors in whole root extracts are having a synergistic effect with berberine. Ongoing work involves HPLC fractionation of whole root extracts in an attempt to identify possible synergists.

136 - Endospore Survival in High Temperature Lipids

Ashley Williams, Jeff Wiles

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Some bacterial species are capable of producing endospores as a means of survival during unfavorable environmental conditions, such as extreme changes in temperature, pH, and ionic concentrations. Endospores will remain dormant until favorable environmental factors return. Endospore-producing bacteria are the causative agent of specific foodborne illnesses (e.g. *Clostridium botulinum*). While extreme conditions may destroy the vegetative cell, destroying the endospore requires autoclaving, dry heat, or ionizing radiation, which are impractical methods of sterilization in the food industry and for the home cook. This experiment was designed to test endospore survival in pure lipids at high temperatures. *Bacillus subtilis* (168) endospores were placed into an aqueous medium, and subjected to canola oil at 191.0 °C and boiling water as a control at 100.0 °C. It was found that there were no live endospores or

bacterial cells present after the subjection to the 191.0 °C oil. Endospores were present in the boiling water. When suspended in an aqueous medium, endospores display wet-heat resistance properties, hence their survival in the boiling water. When exposed to the boiling oil, the hot lipids expose the endospores to dry heat.

137 - Unique Environments and Novel Culture Methods for Isolating Antibiotic-Producing Bacteria in Southeastern North Carolina

Alison James, Hailey Young, RayeAnn Heap, Hadyn Heck, Kevin Kiser, Hannah Mignosa

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Discovery and development of new classes of antibiotics will be key in the fight against antibiotic-resistant infections. While many antibiotics currently in use have been derived from soil microbes, the diverse environments of this planet have yet to be fully explored. As researchers gather samples from unexplored regions across the globe, antibiotic discovery is still hindered because traditional laboratory media have been shown to culture fewer than one percent of the microbes present in soil samples. At UNCW, undergraduate students developed innovative approaches for isolating and identifying antibiotic-producing bacteria from environmental samples gathered in southeastern North Carolina. Environmental samples were chosen based on their unique physical and chemical characteristics. Culture methods were then devised to mimic environmental conditions with the expectation that growth of fastidious microbes would be enhanced. Methods included the use of: (1) acidic media to culture acidic soils from swamps in Carolina Beach State Park; (2) media produced from extracts of wire-grass shoots to culture bacteria from the rhizosphere of wire grass; (3) media made from lake water and soil extracts to culture soils from the banks of Lake Waccamaw; (4) VL55 defined-media for rarely cultured bacteria from pyrogenic soils of UNCW's Longleaf Pine Forest; (5) media made with pond or ocean water for culturing sandy soils from similar locations; and (6) nitrogen-free agar to investigate the microbiome of *Sphagnum* moss. From these diverse approaches, students cultured environmental bacteria and identified antibiotic activity by overlaying cultures with test bacteria and looking for zones of inhibition. Several previously undiscovered antibiotic producers were isolated. Characterization of the active compounds will be performed to determine whether these are novel findings that may pave the way for future antibiotic development.

138 - The Use of *Caenorhabditis elegans* N2 Model System to Investigate *in vivo* Interaction Between *Bacillus thuringiensis kurstaki* and a Novel Bacteriophage

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The use of bacteriophages as a potential alternative to antibiotics for treating bacterial infections is relatively unexplored. Using the model system Caenorhabditis elegans, the objective of this project is to investigate the ability of a novel bacteriophage to protect the nematodes from the negative physiological impact following bacterial exposure. Specifically, ingestion of Bacillus thuringiensis has been shown to decrease the rate of reproduction in C. elegans (Luo et al. 2013). The bacteriophage Archie14 effectively lyses Bacillus thuringiensis kurstaki (Btk). Preliminary data suggests prior ingestion of Archie14 by C. elegans will be protective for subsequent exposure to Btk. The rate of reproduction will be measured by the carbon dioxide output to indicate the relative population and metabolic output of the C. elegans population. The majority of our experiments thus far have consisted of creating a closed system and determining the most accurate way to measure the carbon dioxide output of the C. elegans. Our results suggest our control group has a carbon dioxide output ranging between 2500 and 3500 ppm over a three-day incubation period. An alternative killing assay protocol is also being tested to determine any protective effects of Archie 14 for Btk exposure. The

investigation of the in vivo interactions of phage and host bacteria is a potential alternative to antibiotics.

139 - Detection of *Legionella pneumophila* and other *Legionella* species in commercial potting soil

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Legionnaires disease is a form of pneumonia noted for a high mortality, primarily effecting those over the age of fifty and individuals with chronic pulmonary disorders. The ailment is caused by bacteria of the Legionellaceae family, with *Legionella pneumophila* serogroup 1, being the most prominent cause. The primary point source for Legionnaires disease is through aerosolized water (e.g. cooling towers, decorative fountains), however, the mode of transmission remains elusive in many cases. One lesser understood source of exposure is via commercial potting soil and composted material. Previous international research has found both *Legionella pneumophila* and *Legionealla longbeachae* in these sources, however, to our knowledge, comparable survey work has not been undertaken in the United States. In this study, we example commercial potting soil obtained from multiple brands, locations and times for *Legionella* using a two-part approach. First, we utilize culture dependent detection following ISO 11731(2017) methodology. Second, we extract total DNA from samples and use a culture independent approach with Quantitate PCR to detect the bacterium.

140 - Evidence for Antimicrobial Properties in Fresh *Aloe vera* Gel Extracts

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Aloe vera is a common plant species with many claimed medicinal uses not necessarily proven by science. A few claims include burn remedies, cavity fighters, improved digestion, and detoxification. Data were collected from bacterial inhibition experiments of thirteen bacterial species on agar plates to see if A. vera does indeed have anti-microbial properties that could be associated with the claims made by many pharmaceutical and health companies. Agar diffusion experiments with filter discs of gel extracts prepared from fresh leaves, along with positive and negative controls, were performed. The results showed A. vera inhibited the growth of certain species of bacteria. Micrococcus luteus was the most affected bacterium so far, with an average inhibition ring measuring ~7.5 mm. This bacterium species is commonly found on human skin and in the air, but is usually harmless with only a small possibility of being a pathogen to people with compromised immune systems. Further experiments will attempt to eliminate extraneous variables and find a new extraction method for the gel to produce more consistent results. This study will potentially encourage further research to find new possible uses for the plant, along with possible side effects of the plant's antimicrobial activity on the human body.

141 - Vascular flora and wetland assessment of wetlands in the Red River Gorge Geological Area and Clifty Wilderness in Menifee and Powell counties of Kentucky

Calvin Andries, Brad Ruhfel

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Given that Kentucky has lost over 80% of its historical wetland communities, documenting species diversity and habitat quality for the remaining wetlands is crucial for their conservation and management. Furthermore, little is known about certain wetland types (e.g., upland forested wetlands) and there is little data for areas within the Appalachian Plateau

Physiographic Province. Documenting species composition and quality of these wetlands will provide baseline data for these habitats and allow better calibration of habitat assessment measures such as the Kentucky Wetland Rapid Assessment Method (KY-WRAM) and the Kentucky Vegetation Index of Biotic Integrity (KY-VIBI). This study will conduct a vascular flora of three wetland communities within the Red River Gorge Geological Area and the Clifty Wilderness of Kentucky. Three habitat quality assessments, a Floristic Quality Index, KY-WRAM and KY-VIBI, will also be conducted for each wetland. The results of the three quality assessments will then be compared to determine if there is a difference in the habitat quality suggested by the different measures. One assessment method, KY-VIBI is newly developed, and it is not well understood if wetland quality scores will vary based on the time of year the assessment is conducted. The KY-VIBI will be conducted four times during the growing season at each wetland to determine if there is any change in the resulting quality score. As a part of this project, we will collect voucher specimens to be deposited in the Ronald L. Jones Herbarium at Eastern Kentucky University that will document the vascular plant diversity in these unique communities. The species lists will be publicly available through the SERNEC Symbiota Portal (http://www.sernectportal.org), with all vouchers directly linked to each species.

142 - Past, Present, and Future of the David J. Sieren Herbarium at UNC Wilmington

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The David J. Sieren herbarium (WNC) at the University of North Carolina Wilmington (UNCW) contains over 24,000 specimens of vascular plants, fungi, macroalgae, bryophytes, and lichens. The herbarium was established in 1965, growing to nearly 3000 specimens by 1970 via gifts from Ann McCrary of UNCW and Harry Ahles from UNC Chapel Hill, and exchanges from UNC Chapel Hill herbarium. Over the following decades, the collection grew under the direction of David Sieren (land plants), Donald “Fritz” Kapraun (algae), and David Padgett (fungi). Today, the collections are curated by Darin Penneys (land plants), and Wilson Freshwater (algae). Located at a coastal university 8km from the Atlantic Ocean, WNC holdings center on the coastal plain flora and near-shore algae of North Carolina. Notable vascular plant holdings include duplicates from the *Manual of the Vascular Flora of the Carolinas* by *Albert* Radford, Harry Ahles, and C. *Ritchie Bell*; vouchers from the *Flora of Sandy Run Savannas State Natural Area* by Dr. John Taggart; and Cape Fear Arch endemic plants including federally endangered *Carex lutea* LeBlond and *Thalictrum cooleyi* H.E. Ahles. The macroalgae collection contains two holotypes, eight isotypes, and includes specimens from the Faroe Islands, Panama, Norway, and Tanzania. Undergraduate student herbarium assistants learn basic natural history collection care, mounting of specimens, digitization, pest control, and also collect plants and fungi as part of a long-term, student driven campus inventory. Graduate student involvement includes collections for a thesis on the *Flora of Carolina Beach State Park*. The Macroalgal Herbarium Portal (www.macroalgae.org) hosts 6650 digitized algal specimens from WNC, and the vascular plant collection is currently being digitized and will be available via SERNEC.

143 - Digitizing the Tater Hill Plant Preserve Collections

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The Southern Appalachian Mountains are home to numerous unique and sensitive plant communities that contain a large amount of our biodiversity. The Tater Hill Plant Preserve was constructed to protect some of these rare community types and the species they contain. This 1,200 acre preserve is part of the Amphibolite Mountains macro site located north of Boone,

NC. The goal of this project was to digitize the ASU herbaria inventories from past collections. Beginning in 2017, all collections from the preserve, including faculty and student collections, were organized and photographed. Herbarium records were searched, updated, and all data was finalized and compiled into the S.E.R.N.E.C. database. This effort produced a working list of 792 taxa including 237 genera in 87 families. This project emphasizes the importance of biological inventories and their value to the scientific community. These are the baseline data for additional research including the understanding of species distribution, land management issues, and conservation efforts. Ultimately, we will use this data to produce a digital key for the preserve that can be used in future inventory efforts and for educational purposes.

144 - A Story Map of the Existing Collections of Augustin Gattinger

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There are approximately 1100 surviving specimens of the first botanist of the state of Tennessee, Augustin Gattinger. Gattinger was an immigrant to Tennessee from Germany in 1849. He is considered Tennessee's first academic botanist and his original herbarium collection was the foundation for the herbarium at the University of Tennessee, Knoxville (TENN). However, much of Gattinger's collection was lost in the Morrill Hall fire at the University of Tennessee in 1934. In 2017, a team from University of Tennessee at Chattanooga imaged and databased 346 of Gattinger's specimens that are currently housed at TENN. These specimen are now available on the SERNEC portal. Using these 346 digitized specimens, and an additional 733 specimens found on the SERNEC database, an ArcGIS story map was created to visually show when and where the accessions were collected in the past. The process of data collections for this project, databasing, imaging, and the finished map will be displayed and discussed. Through this process we found that 575 specimens contained county-level information; 96% of these were made in Middle Tennessee. Collections of the eastern and west portion of the state represent the lowest quantities at >1% and 3% respectively. This story map also shows that the largest portion of collections we have from Gattinger occur in the time span of 1878-1880, with 59% of collections where the date was included.

145 - Multi-year Comparative Analysis of Maple Species for Syrup Production

Jacob Peters[1], Ryan Huish[1], Ben Munson[1], Kyle Hill[2], Kaitlyn Kessinger[1]

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Sugar maple (*Acer saccharum*) is a key cultural resource from northeastern Canada to southern Appalachia. Due to unforeseen environmental circumstances such as climate change, this cultural icon may be threatened with population range shifts, decreased health, reduced sap production, or inferior sap quality. This may be particularly relevant in the southern extent of its range: the mountains of southern Appalachia. To help prepare for these changes, some producers have begun tapping additional species, including red maple (*Acer rubrum*), box elder (*Acer negundo*), or silver maple (*Acer saccharinum*). In the 2016 and 2017 tapping seasons, data were collected on sap volume and sugar concentration for each species. Sap production was recorded in kilograms (kg) using a hanging scale, while sugar concentration was quantified in units of Brix (° Bx) using a field refractometer. Statistical analyses point to *A. negundo* as a likely alternative to *A. saccharum* due to its high capacity for sap production. Results suggest that diversifying maple species as sap sources may be a viable strategy for maple producers to boost profits or prepare for environmental change.

146 - Somatic embryogenesis in a critically endangered African violet

T. Warner Lowry, Michael Renfroe

James Madison University, Harrisonburg, VA

The *in vitro* propagation of plants through somatic embryogenesis is a promising method for the production of plants in species that are endangered, commercially valuable, or otherwise difficult to propagate through traditional horticultural methods. Leaf and petiole explants of critically endangered African violets (*Saintpaulia rupicola* B.L. Burtt) will be cultured on Murashige and Skoog (MS) (1962) basal media that is supplemented with various concentrations and combinations of auxins and cytokinins. The auxins and cytokinins being evaluate may include 2,4-dichlorophenoxyacetic acid (2,4-D), naphthaleneacetic acid (NAA), indoleacetic acid (IAA), benzylaminopurine (BAP), and thidiazuron (TDZ). These plant growth regulators will be used for either induction media that the explants remain on throughout their development, or induction media followed by growth media that the explants are moved to after 10 days on the induction media. These experiments seek to inform the plant growth regulator and culture conditions choices used for the production of somatic embryos in African violets, in the hopes of creating a system that effectively produces new plants in mass for the purposes of conservation.

147 - Chemically Induced Phytoextraction using Switchgrass by Exogenous Application of Plant Hormone (GA_3), Nitric Oxide Donor (SNP) and Plant Growth Regulator (DA-6).

Sigurdur Greipsson

Kennesaw State University, Kennesaw, GA

Efficiency of chemically induced phtyoextraction was examined by growing switchgrass in lead (Pb)-contaminated soils. Exogenous application of plant hormone (GA_3), nitric oxide donor (SNP) and plant growth regulator (DA-6) were tested separately and in combination in pot experiments in an environmentally controlled greenhouse. Foliar application of SNP (sodium nitroprusside dehydrate) alone and combined application of SNP and GA_3 (Gibberellic acid) improved significantly Pb concentration in plant foliage in comparison to Control plants and plants treated with GA_3 alone. Also, foliar application of DA-6 (diethyl aminoethyl hexanoate) improved significantly Pb concentration in plants foliage in comparison to Control plants.

148 - Coastal grassland species vary in tolerance to salinity and drought

Audrey Kirschner, Julie Zinnert

Virginia Commonwealth University, Richmond, VA

Climate change effects shift distributions of grass species that stabilize coastal sediments and offer protection to inland communities. Coastal species are sensitive to climate change as they are influenced by both atmospheric and oceanic drivers (i.e. changes in temperature, precipitation, and sea level rise). To understand the tolerance of coastal grasses to climate change stressors, our objective was to quantify responses of two dominant grassland species (*Spartina patens* and *Fimbristylis spadicea*) to saline flooding and drought stress. Field collected plants were subjected to varying levels of saline flooding (2, 5, 10, 15, and 20 g L^{-1}) and drought (well-watered vs water withheld). Weekly measurements were taken for functional traits and physiological responses, which included stomatal conductance (g_s), electron transport rate (ETR), water potential (ψ), tissue chlorides, and specific leaf area (SLA). Both species exhibited physiological responses to increased salinity. Stomatal conductance (g_s) reduced significantly following initial treatment exposure and recovered briefly. *Spartina patens* recovered at levels of 5 g L^{-1} and *F. spadicea* recovered at levels of 10 g L^{-1}. SLA declined in both species, but was more reduced in *F. spadicea*. ETR significantly decreased for both *S.*

patens and *F. spadicea*. Tissue chlorides were highest in saline flooded *F. spadicea* plants compared to *S. patens*. Drought treated plants had significant declines in all measured parameters. Overall, *Spartina patens* was more tolerant to saline flooding and drought treatments than *F. spadicea*. This outcome reflects the varied distribution of *S. patens* from drought induced dune environments to saline flooded marshes and has implications for future community composition with climate change.

149 - Comparative Ecophysiology of Two High Elevation Conifers in the Southern Appalachian Mountains: The Importance of the Winter Season

Zane Sink, Rachel Jordan, Howard Neufeld

Appalachian State University, Boone, NC

Southern Appalachian spruce-fir forests are glacial relicts, located as disjunct “islands in the sky” on the highest peaks in this region. Fraser fir (Abies fraseri), an endemic and valuable Christmas tree, dominates at elevations > 1650 m while red spruce (Picea rubens), occurs at lower elevations (1380 – 1650 m). Winter in this forest type brings extended periods of snowfall and freezing temperatures, but is not as severe as in northern boreal regions. Southern spruce-fir forests have longer winter photoperiods, more frequent midwinter thaws, and fewer, less severe subzero temperatures. Despite milder winters in the south, this season still constitutes a substantial portion of the annual cycle for these evergreen trees, yet its importance to the ecophysiology of these trees is poorly understood, as are the potential impacts of milder winter conditions resulting from climate warming. Warming may result in more frequent occurrences of mild temperatures, shortened durations of thaws, free soil and stem (capacitance) water for uptake by trees, stimulate below- and above ground respiration, and enhance carbon uptake via photosynthesis. Our study aims to address this knowledge gap by measuring the comparative ecophysiology of both species during winter on Grandfather Mountain, NC. These measurements are currently underway and results will be reported at the meeting. We hypothesize that if soil thaw allows water transport, stomata may open and mild daytime temperatures could enhance winter photosynthesis, enhancing the annual carbon budget. But if soils remain frozen, the lack of available water could prevent stomata from opening, resulting in relatively more respiration than photosynthesis, thereby reducing the annual carbon budget. We also predict south-facing needles will have higher levels of pigments than north-facing ones, but will be more prone to photoinhibition on cold days. Additionally, varying degrees of needle retention between the species could affect their responses to winter warming.

150 - Evaluation of different chelating agents used in lead (Pb) phytoextraction.

Sigurdur Greipsson

Kennesaw State University, Kennesaw, GA

The effectiveness of four different chelating agents (phytic acid, citric acid, NTA, and EDTA) were tested for lead (Pb) phytoextraction of switchgrass (*Panicum virgatum*). Plants treated with citric acid (($C_6H_8O_7$) alone showed significantly higher shoot Pb concentrations compared to Control plants and plants treated with phytic acid. Examining Pb-solubility by soil washing (using 0.01 and 0.05 M glacial acetic acid) revealed no significant differences in Pb concentrations of soil among different chelate treatments and control.

151 - Ginsenoside Profiles of American Ginseng (*Panax quinquefolius* L.) Populations in Western North Carolina

Andrew Warren, H. David Clarke, John W. Brock, Jennifer Rhode Ward, Jonathan Horton

University of North Carolina Asheville, Asheville, NC

American ginseng (*Panax quinquefolius* L.) is a threatened perennial understory plant endemic to eastern North American deciduous forests. Ginseng has been overharvested and poached due to its value as an herbal and folk medicine. The medicinal value of the plant is derived from ginsenosides, defensive triterpenoid saponins produced in *Panax* species. Over 40 ginsenoside molecules have been described, and phytochemical profiles can be used to identify variation within and among ginseng populations. Additionally, these data will assist efforts to breed cultivars labeled for specific medicinal properties, ideally reducing the demand for wild harvested ginseng. The diversity of ginsenoside profiles in ginseng populations in the Appalachian region is of particular interest, due to the glacial refugia created during the Pleistocene epoch. We analyzed the ginsenoside profiles in 157 roots from 17 NC populations using methanol-reflux extraction, separation by high performance liquid chromatography, and detection by ultraviolet spectroscopy. Six ginsenosides (Rb1, Rb2, Rg1, Re, Rd, and Rc) were characterized and quantified. We found that most populations exhibited an RG chemotype (Re/Rg1<1), with three populations showing small variation in chemotypes. Concentrations of Rg1 and Rb1 were highest across all populations, while Re concentrations were lowest. The individual ginsenoside concentrations were higher than in prior studies. While chemotypic diversity was low among the WNC populations, individual ginsenoside concentrations varied widely. Future studies of these populations could address the etiology of variations to determine genetic and/or environmental factors.

152 - The Lighter Side: Physiological Properties of Adaxial and Abaxial Surfaces in Leaves of 33 Different Species of Plants

Austin Quint, Howard Neufeld

Appalachian State University, Boone, NC

Adaxial (top) and abaxial (bottom) leaf surfaces commonly show differences in physical properties that may influence leaf functioning. Among these are leaf surface coloration, where both surfaces may be similarly colored, or one surface may be much darker than the other. Observations consistently show the abaxial surface to be lighter than the adaxial surface, suggesting that it has a higher reflectance. Such differences in reflectance may have important implications for the optics of a leaf. However, why the abaxial surface should always be more reflective, or if there are any phylogenetic or environmental correlates with this phenomenon, are not well understood. Our initial working hypothesis is that abaxial leaf surfaces are more reflective in order to minimize the entry of photosynthetically active radiation into the lower leaf layers, where spongy mesophyll cells prevail. When light enters leaves adaxially, red and blue wavelengths attenuate rapidly in the palisade mesophyll, leaving mostly green light to reach the spongy mesophyll. If excess light enters abaxially, it could result in photoinhibition of the spongy mesophyll and reduced photosynthesis. We collected leaves of 33 different species (both herbaceous and woody) during late summer and early fall and measured the reflectance and transmission (380-1020 nm) of their adaxial and abaxial surfaces using an Ocean Optics Spectrometer. In all instances, abaxial surfaces were more reflective than adaxial surfaces, with differences in reflectance sometimes reaching as much as 35%. Transmittance showed minimal differences between surfaces. Reflectance differences between surfaces were largest between 600-800 nm, suggesting that abaxial surface reflectance may also protect the leaf from too much red/near-infrared radiation. Chlorophyll concentrations were also measured to determine if differences in reflectance between surfaces are related to chlorophyll amounts. We are also making Scanning Electron Microscopic images to relate differences in reflectance with structural attributes of the leaf surfaces.

153 - Teaching Soil Forming Factors: Topography using ESRI Story Maps

Michael Cope, Elena Mikhailova, Christopher Post, Mark Schlautman, Patricia Carbajales-Dale

Clemson University, Clemson, SC

Environmental Systems Research Institute (ESRI) Story Maps are web applications based on maps and other multimedia which can be effectively used in soil science education. The purpose of this study was to develop an ESRI Story Map "Soil Forming Factors: Topography" for teaching in introductory soil science courses and to assess the performance of the newly-developed story map using ESRI's "five principles of effective storytelling" and user responses to a quiz testing the acquired knowledge. Specific learning objectives were stated on each "story map page" as well as throughout the learning materials. Navigation of each "story map page" is controlled by the participant via tabs to allow the user to control the pace of the learning experience. Participants received an average score of 8.2 (out of 9 maximum points) for the quiz. The ESRI Story Map scored well for each principle of the ESRI's "five principles of effective storytelling" with more than 70% of responses having "excellent" rating. Additional comments suggest that participants were positive about the ESRI Story Map as a stand-alone teaching tool or in combination with power point slides. The ESRI Story Map "Soil Forming Factors: Topography" can be further improved by incorporating interactive exercises.

154 - Teaching a Non-Majors Biology Online Lab Course

Pearl Fernandes, Daniel Kiernan

University of South Carolina Sumter, Sumter, SC

Human Biology laboratory (BIOL 120L) is designed as a companion laboratory for the Human Biology lecture course (BIOL 120). This course is considered a non-science majors course but is also taken by science majors as an elective to build a foundation for upper division courses. The learning outcomes are focused on gaining an understanding of the organization and working of the human body and the role of genetics and the environment in human disease through hands-on learning. Students gain an understanding of the scientific method, learn to interpret scientific data and learn the scientific reasoning behind some major human biology concepts. Biology 120 and 120L were converted to online courses during the summer of 2013 in an effort to give non-science majors more flexibility in fulfilling their lab science course requirements. This conversion was timely with the birth of Palmetto College at the University of South Carolina. Through our poster presentation, we will discuss the laboratory modules that were designed to meet online student needs, and student feedback on these modules.

155 - Investigation of Potential Correlation between Mindset and Attitude towards Active Learning, in an Internationalized Non-majors Biology Class.

Pratima Darr, Marty Thomas, Wendy Dustman

Georgia Gwinnett College, Lawrenceville, GA

With burgeoning efforts to flip and partially flip classes, a decided trend of resistance toward active learning has been documented. This resistance may be compounded in classes that involve non-majors as there is an added level of resistance to classes perceived as "not applying towards individual career and life choices". This is indeed, what I noticed when I flipped the classroom for a non-majors biology class focusing on biodiversity and sustainability and taught within the parameters of established objectives of internationalization, at Georgia Gwinnett College, in fall, 2014. I have developed a pronounced interest in investigating where the resistance to active learning stems from and whether interventions can be used to channel this so as to foster metacognition. It sought to probe a connection between mindset as described by acclaimed cognitive psychologist Carol Dweck, and a student's attitude towards active learning. My approach involves use of a mindset quiz developed by K-12 learning specialists to assess individual mindset and then see if that correlates with their attitude towards active learning, based on a validated survey and feedback obtained from the use of Keep, Quit, Start cards as described by Seidel and Tanner. There are four mindset categories which are correlated with four rankings of attitude towards active leaning. ANOVA analysis of

data from the last two semesters indicates that individual mindset and confidence in active learning practices do correlate. Based on this finding, interventions to reinforce adoption of increasingly growth-centered mindsets, will be developed so all students, including those in STEM majors, may become more involved citizens of an increasingly uncertain world.

156 - From classroom to trail: using a citizen science approach to study tree phenology and global change on a college campus

James Kitchens, Alison Blount, August Starck, Amy Boyd, Liesl Erb, Alisa Hove

Warren Wilson College, Asheville, NC

Phenology, or study of the timing of seasonal events in the life cycles of plants and animals, provides numerous opportunities for students and members of the general public to both consider the influences of climate on biological systems and hone their skills in observation and data collection. In Summer 2016, we established a phenological monitoring trail on the campus of Warren Wilson College (WWC, Swannanoa, NC). Over the past 18 months, WWC students have used established protocols from the USA National Phenology Network Nature's Notebook program to monitor the vegetative and reproductive phenology of 14 tree species native to the southeastern USA on a weekly basis. To date, we have reported over 38,000 observations to Nature's Notebook. This effort, involving students in Ecology courses and research interns, has stimulated classroom discussions of the ecological and genetic factors that influence the timing of phenophases, as well as the implications of variation within and among species in their phenological sensitivity to climate and of phenological mismatches as the global climate changes. The poster will highlight phenological data collected by students (directly and from the national database), as well as the methodology used for trail establishment, organizing monitoring efforts, and engaging students in this endeavor.

157 - Rocking Out in Cedar Glades: Activities to Promote K-12 Engagement in Ecology and Conservation

Kim Sadler

Middle Tennessee State University, Murfreesboro, TN

Public understanding about protecting and preserving biodiversity should begin during the formative years. Although most Middle Tennessee K-12 students can tell you something about the tropical rain forest, we suggest that prior to our outreach efforts, few knew anything about a limestone cedar glade. Found in the Central Basin of Middle Tennessee, glades support several rare plant species on thin soil and exposed rocky patches. Viewed as wastelands, much of this fragile system has been severely impacted by humans. To promote awareness and conservation, the Center for Cedar Glade Studies at Middle Tennessee State University developed educational resources that develop knowledge about cedar glades. Teacher teams designed and developed grade-level appropriate and standards-based resources for K-12 and informal educators interested in teaching about limestone glades. Through partnerships with area schools, several local high school teachers now have ecology classes conducting field research and presenting findings at the Tennessee Academy of Science annual meeting. Another successful approach to teaching about cedar glades and reaching a broader group of students has been accomplished by bringing the cedar glade to school. Through partnerships with local developers and parent support, two local schools have created glade gardens on their campus by rescuing glade plants from areas under development. The value of local students learning about this unique habitat can't be directly measured; however, a new population of an extremely rare glade plant was recently discovered by a high school student after learning about the plant on a class field trip. Another positive outcome from the Center's effort is Tennessee elementary science textbooks now contain natural history information about limestone cedar glades. The educational outreach success of the Center for Cedar

Glade Studies at MTSU is the result of collaboration with multiple agencies that share the same vision of protecting and preserving biodiversity in Tennessee.

158 - Insects as a model for theme-based instruction in undergraduate ecology: aiming to enhance student learning while addressing the "natural history crisis"

Kara Lefevre

Florida Gulf Coast University, Fort Myers, FL

Training in natural history remains highly relevant to modern-day environmental science, yet there is a growing shift away from teaching taxonomy and other natural history skills in undergraduate science education. One possible cause is that the drive to teach "newer" technical approaches might limit attention on or resources for traditional ones. An alternate view is that natural history training should remain the solid foundation of environmental science education. I designed an intervention in a required General Ecology course to evaluate whether augmenting natural history instruction would enhance student learning. I chose insects as the focus for theme-based instruction because they are ubiquitous, diverse, valued as model systems in biological research, and practical for use in teaching activities. I used a recurring mix of examples, instruction in basic insect taxonomy, and field and lab exercises to position these organisms as a running thread throughout the course. My objectives were to measure the impact of this theme-based curriculum on student performance, compared to prior semesters, and to assess whether students valued the experience of enriched learning about insect ecology within the context of the broader foundation of general ecological principles. To date, data show that almost all students (mean 94%) report that the use of outdoor instruction during our class time enhances their learning of ecology, compared to fewer though still a majority (mean 76%) who report that learning about insect taxonomy in General Ecology is meaningful / useful to them. This presentation will share lessons learned about whether the theme-based curriculum is improving student outcomes and how to best implement this kind of approach to boost the natural history training of the next generation of young scientists.

159 - Integration of Earth-Life interactions into Introductory Biology courses.

Roger Sauterer

Jacksonville State University, Jacksonville, AL

The biosphere and the earth system interact with each other, with life altering the global environment and vice versa. These interactions are often given little emphasis in introductory Biology courses, resulting in students having little appreciation for the mutual interactions of life and the Earth system. I suggest opportunities to emphasize these interactions in the organismal diversity portion of introductory biology courses. Examples of interactions between life and the Earth system include: 1. The advent of oxygenic photosynthesis by cyanobacteria, leading to the Great Oxidative Event , oxidation of atmospheric methane, global cooling, and "snowball earth" glacial episodes 2.5-2.3 GYA. 2. Increase in atmospheric oxygen about 600 – 500 MYA, caused by proliferation of photosynthetic microorganisms, possibly due to increased continental mineral runoff after the "snowball earth" events of 700-580 MYA. Higher oxygen levels may have allowed the development of multicellular animal life and the "Cambrian explosion". 3. Widespread proliferation in the Carboniferous of tree-sized lower vascular plants with lignin-rich stems that were poorly digestible by microorganisms lead to increased burial, generating most coal beds, drawing down carbon dioxide and increasing atmospheric oxygen, resulting in global cooling and late Carboniferous ice ages. 4. Massive volcanism and pyrolysis of underlying coal beds caused extreme global warming, oceanic anoxia and ecosystem collapse over a few tens of thousands of years, leading to the Permian mass extinction, resulting in proliferation of reptiles and seed plants afterward. 5. Massive volcanism and/or impact in the late Cretaceous led to extinction of nearly all large animals, allowing for adaptive

radiations of both the mammals and the smaller birds. 6. Current human activities resulting in rapid global warming, massive habitat loss, over-harvesting of aquatic and land animals, leading to poorly-understood but likely serious consequences on the global ecosystem.

160 - Case studies enhance basic concepts in undergraduate genetics course

Linda Niedziela

Elon University, Elon, NC

A set of interesting case studies were chosen to reinforce basic concepts covered in a sophomore level genetics courses at Elon University. BIO245 is an intermediate level required major's course in genetics with a capacity of 20-24 students. It builds on an introductory cell biology prerequisite. The goal of the BIO245 is to immerse students in transmission and molecular principles of genetics and the applications of these principles to the modern world. The students in the course are expected to learn foundational concepts but also engage in critical thinking, problem-solving and application of knowledge. These course objectives seemed to fit well with the strengths of case studies. So in 2017/2018 academic year, the course was modified to include a series of case studies that supplemented other pedagogical techniques. The major principles were chosen first and included Mendel's laws; meiosis and mitosis; sex determination and chromosomal abnormalities; gene expression; gene regulation; and mutation. Case studies were either written by the instructor or selected from the National Center for Case Study Teaching in Science that matched and applied these principles to real world situations that would hopefully engage students. Student evaluations of the instructor and course were not significantly affected by the methodology change and the majority of students responded positively about the experience. One positive outcome observed, but not objectively measured, was the increased sophistication of student explanations of concepts when related to a case versus more generalized essay answers. Future plans are to assess student learning through pre- and post- test questions and in-depth analysis of essay answers.

161 - Role-playing activities to demonstrate complex cellular processes

Elizabeth Harrison

Georgia Gwinnett College, Lawrenceville, GA

Transport of molecules across the cell plasma membrane can be a difficult concept for introductory biology students to understand and visualize. Role-playing activities provide a simple, cost-effective method for enhancing student understanding of various challenging biological concepts. This cell membrane role-playing activity was designed to teach introductory biology students how small nonpolar and polar molecules cross the cell membrane as well as the importance of diffusion, osmosis, and tonicity.

162 - The UNCW Fish Collection: A Resource for Ichthyology Research and Education

Tom Lankford

University of North Carolina Wilmington, Wilmington, NC

The University of North Carolina Wilmington's Fish Collection, established by the late Dr. David G. Lindquist, is maintained by the Department of Biology and Marine Biology and provides extensive material in support of ichthyological research and education. The research collection consists primarily of alcohol-preserved specimens and includes >32,000 cataloged and >20,000 uncatalogued specimens representing >340 genera and >700 species. Entries (>1,500 lots) span the period 1975-present, providing extensive coverage of 1) marine fishes of the Carolinian province, 2) freshwater fishes of the lower coastal plain of the Cape Fear River drainage, 3) larval fishes of the Onslow Bay mid/outer continental shelf and adjacent Gulf

Stream, 4) juvenile fishes of estuarine and ocean surf habitats in southeastern North Carolina, and 5) freshwater endemics of Lake Waccamaw. Geographic coverage includes material from Ecuador, California, Mexico, Bahamas, Florida Keys and southern Appalachia. Also included is an undergraduate teaching collection of isopropyl-preserved juvenile and adult specimens representing >275 species common to marine, estuarine and freshwater habitats of coastal North Carolina, along with skeletal preparations, cleared and stained specimens, digital photographs and otolith reference sets. The collection catalog has recently been digitized with the goal of providing an on-line, searchable database. Housed within the UNCW Vertebrate Museum, the fish collection has reoccupied renovated facilities in Friday Hall. Ichthyologists interested in accessing the collection are invited to contact Dr. Tom Lankford, Curator of Fishes, at lankfordt@uncw.edu.

163 - Recruit and Engage Math and Science Teachers - REMAST Phase II, Year 4, Newberry College, SC

Alexis Nystrom[1], Marial de Lachica[2], Cynthia Aulbach[2], Charles Horn[2], Christina McCartha[2]

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Funded by the National Science Foundation's Robert Noyce Teacher Scholarship Program, Newberry College has entered the fourth year of our second five-year grant to Recruit and Engage Science and Math Teachers (REMAST). The primary goal of REMAST is to place secondary education science and math teachers with strong content-area knowledge into high-need school districts. To accomplish this, we have partnered with school districts in surrounding counties to allow our Scholars to explore and experience teaching in diverse settings with select mentor teachers. We provide opportunities for Scholars to serve as supplemental instructors in math courses and teaching assistants in science labs; this gives Scholars a stronger background in their content areas preparing them for Praxis content exams as well as for student teaching. We offer at least six Professional Development meetings during the school year where Scholars, mentor teachers, our Scholar graduates who are now teaching in their fields can share experiences and learn from each other in a somewhat informal setting while also attending a program or presentation in various areas from pedagogy to technology. Most important, especially for a small liberal arts school, we're able to provide opportunities for our Scholars and Scholar graduates to attend content-specific conferences, such as ASB, and national and regional math and chemistry conferences. We're also able to support our Scholars and graduates to attend grant and teaching conferences to include National and Regional Noyce Conferences, the National Science Teachers Association Conferences, and educational technology conferences. Our Scholars broaden their horizons and gain enthusiasm from these conferences and they begin to network in their disciplines as well as in the teaching field. The support from REMAST has evolved into a Professional Learning Community; this then has led to improved teacher engagement and persistence in the profession. NSF Award Number 1439839.

164 - Tying it all together: Understanding animal diversity and phylogenetics using string

Christopher Brown

Georgia Gwinnett College, Lawrenceville, GA

Students often have difficulty visualizing evolutionary relationships given the vastness of geological time and the disparity of phenotypes in modern forms. I have developed a simple classroom activity to help students draw and interpret phylogenetic trees using cards and string. First, attach a long string to a wall at both ends. Then give each student one or more cards containing a picture and short description of an animal, depending on class size, and a clip. Each card is unique. Students should recognize the animal, but the description should not contain information which might reveal its higher taxonomy, such as "mammal". The instructor

begins by clipping two additional cards to the string. The instructor then shows a third animal card. This card can be placed next to one of the animal cards already clipped to the string, indicating it is more closely related to that animal, or away from both, indicating they are more closely related to each other. One by one, the students walk to the board and add their card to the string. They may ask for help from the class as a whole or move cards already clipped there. When all cards are attached, discuss how the animals are grouped. The instructor or students can then work to draw a phylogeny of these groups using traits the animals possess. Furthermore, students can be given sequences of representative species to be used in a phylogenetic analysis program such as PAUP to check the class tree. This activity is low-stakes and gets the entire classroom involved as a group. It also points out student misconceptions about relationships of common taxa and can be done with any taxonomic group, not just animals. It might work better with more specific groups, where their relationships can be more precisely determined using fewer genes.

165 - Next Steps: Measuring the Success of Efforts to Increase Student Engagement

Dawn Simms

FMOL University (FranU), Baton Rouge, LA

Since 2014, the Sciences faculty at Franciscan Missionaries of Our Lady University (formerly Our Lady of the Lake College) have been focused on efforts to facilitate active learning and increase engagement among undergraduate students. To this end, CURES (course based undergraduate research experiences) have been integrated into over a dozen undergraduate Biology and Chemistry courses. In addition, SIRE (supervised independent research experience) project stipends have been awarded to 22 undergraduate students, and 8 students have already enrolled in the new BAI (biochemical analysis and instrumentation) concentration, launched in the Fall 2016 semester and targeting students pursuing graduate school and/or research careers. In order to examine whether efforts to increase student engagement have been successful (and to highlight any remaining areas of concern), multiple forms of qualitative and quantitative assessment data were reviewed. Qualitative assessment tools included NSSE (National Survey of Student Engagement) data for engagement indicators, EDAT (Experimental Design Abilities Test) data, and student responses from lab confidence surveys. Quantitative assessments included numbers of students presenting posters and projects at the Annual Research Showcase and/or national conferences, trends in student retention rates, and results from instructor-submitted course reports.

166 - Helping Students Succeed: A Successful Redesign of an Introductory Biology Curriculum

Emily Prince, Lisa McDonald

Lander University, Greenwood, SC

Biology is one of the most popular majors among incoming freshmen at Lander University. However, the introductory biology curriculum has historically been a significant hurdle, with many students leaving the program after their first semester. One contributing factor is that many students are academically underprepared for college-level courses. Furthermore, many students passing introductory biology have demonstrated poor retention of the basic biological content covered in the course. To address these challenges, we transformed the single-semester course into a year-long sequence. We engaged in backwards course design, first writing measurable student learning outcomes and then designing instructional tools for specific topics. We also reduced class sizes from a maximum of 60 to a maximum of 36 students. This provided additional classroom and instructor time for active learning, more thorough treatment of complex topics, and opportunities to practice quantitative, writing, and critical thinking skills. The effects on student grades after the first semester of revision have been dramatic. The percent of students with a class average of 70% or higher increased from

39.7 to 67.1 percent. An increase in the percent of students scoring 70% or higher on the cumulative final exam from 28.8% to 56.0% suggests improved retention of content throughout the semester. Ultimately, the curricular changes drastically increased the number of students successfully completing the course. Despite increasing the score required to pass, DFW rates fell from 46.0% in Fall 2016 to 30.9% in Fall 2017. The effects of the course redesign on at-risk student populations (i.e., underrepresented minorities, first-generation college students, and students from low-socioeconomic backgrounds) are now being analyzed. Students taking part in the redesigned introductory biology sequence will be tracked to determine the effects of these revisions on their performance in upper-level courses, retention in the biology program, and graduation rates.

167 - The impact of *Bio-Bridge*, a 2-year to 4-year institution bridge program, on student confidence and attitudes

Dominique Levy, Rashad Simmons, Cindy Achat-Mendes, Adrienne Cottrell-Yongye, Jennifer Hurst-Kennedy

Georgia Gwinnett College, Lawrenceville, GA

Bio-Bridge, a bridge program targeting transfer students from local two-year institutions, has recently been implemented at Georgia Gwinnett College (GGC). The Bio-Bridge program aims to increase academic success of GGC transfer students in introductory STEM courses. To accomplish this, students participate in semester-long research projects, under the guidance of GGC Biology and Chemistry faculty, as well as Biology seniors serving as peer mentors, with embedded lessons on study and research skills. Specifically, each *Bio-Bridge* participant designs and conducts an independent study investigating the antioxidant properties of a chosen herbal supplement and its effects on cultured, mammalian cells. Students gained experience in many laboratory and research techniques including literature searches, creation and analysis of graphs, experimental design, spectrophotometry, serial dilutions, redox reactions, antioxidant detection assays, and mammalian cell culture technique. Preliminary data suggest that participation in *Bio-Bridge* increases confidence in scientific communication and improves student attitudes towards research, as measured by the Scientific Communication Self Efficacy Survey (SCSES) and Colorado Learning Attitudes about Science Survey (CLASS), respectively. Here, we present our curricular design, analyses of the pilot study data, and future plans to grow and develop the *Bio-Bridge* program at GGC.

168 - Integrating an inquiry-driven cell culture experience in an upper-level cell biology course

Chris Barton

Belmont University, Nashville, TN

Understanding the basics of culturing animal cells is critical for students wishing to pursue graduate education or enter biomedical research. While undergraduate courses often teach students the theory behind cell culture, the first-hand experience of actually growing living cells in culture is typically not gained until students enter post-undergraduate fields. To some degree, this is understandable as there are a number of obstacles that must be considered when offering such an experience at the college-level. This presentation describes an upper-level course in cell biology, within which students were taught numerous laboratory skills pertaining to live cell culture. Throughout the semester, students were taught a number of culturing techniques including cell growth, cell counting, and a number of functional analyses including, but not limited to, nuclear analysis, mitochondrial and cytoskeletal fluorescent staining, and apoptotic detection techniques. The course culminated in students groups carrying out self-designed experiments addressing a number of issues in cell culture. The hope is that this course will serve as a foundation for future courses to increase student exposure to cell culture laboratories.

169 - Why Science Matters: Personalizing Biology Through Citizen Science

Darlene Panvini

Belmont University, Nashville, TN

Citizen science projects cover a wide range of scientific topics and allow participants to contribute to ongoing scientific studies around the world. They can be incorporated into courses in a variety of ways ranging from individual, to group, to whole-class activities. Some can be completed during a single class session while others can span an entire semester or year. This poster will describe the incorporation of citizen science projects into both majors and non-majors biology courses, as well as projects that covered various time frames and topics. Topics ranged from molecular biology to human health, field studies to urban wildlife. Culminating assignments provided students with opportunities to practice public speaking and presentation skills. One interesting outcome of these projects is the way in which science becomes more relevant and personal to students. Specific examples, including assessments, from a variety of courses will be presented.

170 - The Biological Field Journal: Integrating Observation With Art

Michelle Tremblay, Ed Mondor

Georgia Southern University, Statesboro, GA

A field journal is an essential investigative tool for any budding biologist. Digital cameras and smartphones allow students to easily record visual information, but making detailed sketches sharpens observational skills and facilitates a much deeper understanding of the subject of interest. A key component of a study abroad course we offer, “Biological Field Experience – Exploring the Ecuadorian Amazon”, was the construction of a field journal that would integrate traditional field journaling with art journaling techniques, so students could better engage with the unique culture, biology, and ecology of the most diverse ecosystem on the planet. Students documented details of their journey, species encountered, and their thoughts and reflections, while incorporating field sketching and mixed media art techniques previously taught in class. We found that by combining field journaling with art journaling, students developed a profound emotional connection to their surroundings. Not only did students become much more interested in, and engaged with, the environment, they had a better understanding of how culture and ecology are connected, they better understood themselves, and they became empowered by their creativity.

171 - Engendering a Culture of STEM Learning with a Unique Peer Supplemental Instruction Model

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As an access institution, Georgia Gwinnett College (GGC) attracts students who are often under-prepared for college, especially for STEM courses. We have developed a peer supplemental instruction (PSI) program to aid students as they transition from high school to the higher academic demands of college-level STEM courses. The program supports gateway courses in biology, chemistry, mathematics, and information technology by providing collaborative learning opportunities for students to practice course concepts, while developing essential STEM skills. PSI sessions are facilitated by peer leaders, students who have already succeeded in courses. Leaders attend some sections of these multi-section courses (15-30

sections), providing them the opportunity to refresh on content knowledge and build relationships with students currently taking the course. Leaders also undergo training in preparing lesson plans that incorporate STEM-centered, active learning strategies. In Fall 2017, over 500 STEM majors participated in PSI, a 32% increase compared to attendance in Fall 2016. Furthermore, this amounted to 2,154 PSI interactions between students and leaders, indicating that several students returned for two or more PSI sessions. Assessment of the program revealed gains in student grades and leader knowledge of course concepts since participating in PSI. Moreover, in an attitudinal survey taken at the end of semester, leaders reported on new skills developed including, leadership, communication, time management, confidence in public speaking, and teamwork. These findings reveal that our PSI program has value in enhancing both the academic and professional skills of students attending and leading PSI sessions. Despite the challenges of supporting large multi-section courses, our unique PSI program model has been successfully implemented and appears to foster a culture of collaborative STEM learning in the School of Science and Technology at GGC.

172 - Using tardigrades for inquiry science and mentored scientific research

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Inquiry science and mentored scientific research are effective and empowering experiences for in-service teachers. During an intensive summer research program supported by the Robert Noyce Program at the National Science Foundation, we engaged 29 teachers in a unified team-based research project that involved tardigrade diversity in the Cache River wetland of Southern Illinois. Key elements to that summer program were 1) training by a dynamic professional in the focus area, 2) systematic and well-designed team efforts to collect, analyze and archive data, 3) development of lesson plans scaled for four grade bands (K-2, 3-5, 6-8, and 9-12), and 4) a combined research and pedagogy symposium. A STEM graduate student led each of five research teams that included at least one mathematics, one biology and one physical science teacher. Teachers have continued to work toward a scientific publication that reports their findings. Collectively, teachers have identified nine genera of tardigrades: *Macrobiotus, Milnesium, Echiniscus, Astatumen, Hypsibius, Isohypsibius, Ramazzottius, Pseudechiniscus* and *Doryphoribius*, the latter two of which are new to Illinois. Based on participant responses to surveys, teachers valued the summer research experience, enjoyed working in teams and with scientists, and saw the experience as beneficial to their students. For example, the average response to “I understand better how science is done.” and “I feel more competent teaching my students the skills necessary to conduct scientific research.” was strongly agreed (4.68 and 4.7, respectively). In the ensuring academic year, teachers followed up in a systematic effort to incorporate research skills into their classrooms. They conducted Action Research to assess the impact on student performance. We conclude that student involvement in research using charismatic tardigrades is a powerful method of enhancing teacher knowledge and inquiry teaching, which translate to improved student learning.

173 - Bio-Inspired Materials: Tensile Strength in the Butterfly Proboscis

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As society’s need grows for more complex and precise tools, scientists are turning to nature for inspiration. The Lepidoptera proboscis acts as a self-cleaning feeding tube and an intricate chemical and mechanical sensor system for probing food composition and proboscis movement. This self-cleaning ability comes primarily from the structure of the proboscis. Two hollow, C-shaped tubes called galeae align to create the external feeding tube. The galeae are

composed of hydrophobic chitin and other biopolymers. In search of a synthetic fiber that mimics these unique properties, we explored the effects of the composition of the proboscis on its mechanical properties. We expected the chitin composition and unique geometry of the proboscis to affect its response to tensile stress. Considering two butterfly species, Monarch (Danaus plexippus) and Painted Lady (Vanessa cardui), we used modified dynamic mechanical analysis to collect data for the Young's Modulus, yield strength, and ultimate strength of the galea of the proboscis. While repeatable elastic deformation was observed within a small load application of around 0.1 N, features of the inelastic deformation varied due to mounting techniques and existing flaws in the proboscis. Using 3D microscopy with a HUVITZ optical microscope, we observed the fracture patterns and measured the cross sectional area of each hollow galea on the scale of 0.005 mm2 to calculate the normal stress on the fracture cross section. With this information, we conclude that while these mechanical properties are reliant upon the structure and composition of the proboscis, other factors may also contribute to the proboscis's strength. Additional testing is being explored to characterize the non-elastic deformation region of the tensile tests. This knowledge will help us design new self-cleaning fiber micro tubes with applications in hazardous and nuclear waste disposal.

174 - Changes in Social Form Dominance of Invasive Fire Ants in a Carolina Bay (Antioch)

Grant Wood, Hannah Swartz, Lisa Kelly

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The red imported fire ant *(Solenopsis invicta)* exists in two different social forms, monogyne and polygyne. Both forms apply different means to a common goal, reproductive success. The polygyne's ability to have multiple egg-laying queens improves its chances of reproductive success, which could promote its ability to persist in intact systems, like wetlands. In a Carolina bay (Antioch Bay), both colony forms were present in the year 2013. Before conducting research in the summer of 2017, we hypothesized that, because of prolonged flooding, few colonies would persist and that polygyne colonies would be more common. Using two belt transects, the site was sampled for fire ant colonies. Colony samples were subjected to PCR techniques to genotype the social form. Comparing results from 2013 and 2017, we saw a dramatic drop in abundance of total colonies and a change in the dominant social form (from monogyne in 2013 to polygyne in 2017). We conclude that the disproportionate decrease in monogyne colonies is likely attributed to a reduced chance that the single egg-laying queen will escape flooding. While unclear whether flooding was the underlying cause for these observed changes, it is a likely candidate. Monogyne colonies are territorial, and unlike their polygyne counterparts, resources are not shared among them. Sharing of resources may be critical for the survival of individual colonies where flooded conditions limit access to food. We intend to study how changes in social form dominance may influence the site's native biota.

175 - Spacial Sensitivity of the Proboscis of *Manduca sexta*

Amanda Mayo, Joaquin Goyret, Jonathan Travis

University of Tennessee at Martin, Martin, TN

Adult *Manduca sexta* are large, crepuscular/nocturnal hawkmoths that feed nectar. While hovering in front of a target flower, they extend their long proboscis and inspect the floral surface in search of a nectar reservoir. This inspection behavior has been shown to use mechanosensory (tactile) information, and proceeds using two stereotyped motor patterns. While on a smooth, flat surface, moths use a "tapping" behavior, which quickly switches to a back-and-forth "diving" behavior upon contact of grooved surfaces. Here, we set to use these distinct behaviors to better understand the spatial sensitivity of the tactile sense of the proboscis. As a first approach, we are offering moths 3D-printed artificial flowers of three different kinds: smooth, with grooves of 1 mm or with grooves of 0.1 mm. Evaluating the

probabilities of triggering the diving behavior of the different flower models will allow us to begin to estimate the spatial sensitivity of the proboscis.

176 - Compiling a database for Bumble Bees (*Hymenoptera*, *Apidae*, *Bombus*) of the Southern Appalachian Mountains

Melanie McMillan, Alexia Tompkins, Jennifer Geib

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Preserving research and making sure that the information derived from scientific endeavors is easily accessible for future use is a significant long-term challenge for the scientific community. The objective of our project was to catalogue current and historical records of bumble bee pollinators in the Southern Appalachian Mountains to produce a publicly accessible database that will preserve the data for future collaborative research. We located specimens and records for inclusion in the database through email surveys sent to universities, museums, and federal and state organizations throughout the Southeast. We followed up email requests with phone interviews. We established the Beta draft of the database in Microsoft Access using a dataset of specimens from a 2015 Bumble Bee Megatransect Citizen Science survey of the Blue Ridge Parkway. Future endeavors aim to further convenience of entering data from physical specimens through a new barcode labeling system. Digitizing specimen collections is important for the mobilization of sharing across the region enabling exchange of information, development of practice, and compilation and comparison of data.

177 - The impact of reclaimed surface mines on bee (Hymenoptera, Apoidea) communities in Southeastern KY

Amanda Dunaway, Valerie Peters

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Native bees (Hymenoptera, Apoidea) provide essential pollination services and have been declining in abundance dramatically in recent years. One potential cause of these declines is anthropogenic disturbance. Eleven sites were established in Southeastern Kentucky, U.S.A. where surface mining for coal is common. Native bees were sampled from these 11 sites from 6 counties (Laurel, Clay, Leslie, Letcher, Knott, Perry), which varied in land cover composition with sites having 0- 50% mined land within a 1000m radius. Bees were sampled using pan traps, vane traps, and netting and were then identified to species in the lab. Bees were then classed into functional groups to test for differences in functional group diversity. Data was analyzed using generalized linear mixed models fitted for a Poisson distribution to detect differences in communities on mined and unmined sites. Results of this study show a significant difference in the community composition, species richness, and species evenness between those communities on mined sites and those on unmined sites. Kentucky native bee populations have never been properly censused in this area, so this project has the potential to provide key information on what species are present as well as information for land owners to consider when reclaiming surface mines.

178 - Ant Diet Preference in Urban Environments

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As urban habitats become more common throughout the world, it has become essential to understand how animal diversity varies across them. Ants are numerous, highly diverse, and viewed as extraordinarily adaptable organisms; however, food availability appears to affect the composition of ant species in urban environments. We hypothesize that an ants' physiology

and diet is linked to its success in urban environments. An ants' low diversity can be the result of limited green spaces and human preference in plants, which affects insect diversity and available nutrients. Select thriving ant species have shown the ability to balance the types of food consumed by incorporating human food into their diet. To determine how diet preference of ants may vary across urban habitats, we set out oil, water, and sugar food baits across different habitats in downtown Chattanooga, TN. These habitats consisted of neighborhoods, parks, and street medians. After a period of time, we collected and identified the ant species found at each station. The samples obtained were measured by quantified abundance and diversity. Our results thus far show preference in oil, especially in high traffic areas like neighborhoods while water was the least preferred in each habitat. There was a low abundance of high sugar consuming species like, *Crematogaster spp., Nylanderia spp.,* and *Tapinoma sessile. Tetramorium spp.* which have been shown to thrive in cities, were mainly present in neighborhoods. While our analysis did not support the hypothesis, we have yet to complete our study. In the future, it would be possible to compare how diet preference of urban ants differs from those found in forests.

179 - Do Brown Widow Spiders Stay Close to Mom or Spin Away from the Nest?

Trevor Roberts, Emily Knight, J. Scott Harrison

Georgia Southern University, Statesboro, GA

The brown widow spider (*Latrodectus geometricus)* is thought to be native to South America or Southern Africa, but its distribution has expanded to most continents by human introduction. In the continental USA, *L. geometricus* was first documented in south Florida in the 1930's. In the early 2000's a population expansion occurred, and this species is now found in Florida, Georgia, South Carolina, Alabama, Mississippi, Louisiana, Texas, and southern California. *Latrodectus geometricus* has high fecundity where females can produce 8-15 egg sacs (800-1500+ offspring) from the stored sperm of a single mating event. This species commonly inhabits manmade structures in urban areas. We have observed that most buildings are inhabited by multiple individuals of *L. geometricus*. The purpose of this study is to determine if inhabitants of individual buildings are siblings produced from a single female founder or unrelated individuals that have colonized the building through dispersal. We used mitochondrial DNA (mtDNA) variation for a first estimate of maternal relatedness. mtDNA is maternally inherited so individuals with different mitochondrial haplotypes do not descend from the same mother. Fifteen haplotypes were observed in preliminary survey of 70 individuals collected from nine buildings in Statesboro, Georgia. Of the nine buildings, only 1 demonstrated haplotype frequencies consistent a group of maternally related individuals. These results suggest that *L. geometricus* commonly migrate away from hatching locations and are found in groups of mostly unrelated individuals.

180 - In Pursuit of Common Ground: Evaluation of Cross-Disciplinary Communication Effort between the Fields of Invasion Ecology and Biological Control

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Non-native, invasive species are some of the most prominent forces altering ecosystems on our planet today. Biological control agents are sometimes introduced into invaded ecosystems to help combat these organisms. Often, biological control agents are also non-native species, so their impacts are capricious with respect to efficacy and non-target effects, suggestive of "fighting fire with fire." Given the similarity between non-native, invasive species and their biological control agents, the fields of invasion ecology and biological control should have natural overlap in terms of mechanisms and conceptual ideas, as well as open communication. The aims of this study were to: 1) investigate which disciplines invasion ecologists and

biological control scientists primarily cite in their research; 2) assess the similarities in mechanisms and stages of invasion of invasive pests and biological control agents; and 3) identify areas of overlap between the two disciplines. For this study, we reviewed insect invasion and biological control literature over a ten year (2006-2015) period to evaluate whether the disciplines were communicating through shared literature. We also assessed primary invasion ecology and biological control literature in search of documented stages of invasion for non-native, invasive species and biological control agents. Through bibliometric analysis, we show that biological control literature primarily cites other biological control studies, while invasion literature primarily cites other invasion studies, suggesting a significant area where cross-talk may be facilitated. Furthermore, we propose a new framework, incorporating the stages of invasion of non-native, invasive species and biological control agents to demonstrate the potential for novel utilization of discoveries across biological control and invasion research. Due to shared characteristics with non-native, invasive species, we advocate that biological control agents can provide researchers with an unconventional model by which to study mechanisms of invasion.

181 - Using real-time videography to analyze the clotting process of lobster hemolymph in response to acute bacterial challenge

Sara Farthing, Darwin Jorgensen

Roanoke College, Salem, VA

When *Homarus americanus* is exposed to an acute bacterial challenge, a rapid immune response is elicited involving the mobilization of circulating immune cells (called hemocytes) which form aggregates that surround the foreign bodies using a mechanism similar to the process of hemolymph clotting. It is proposed that this aggregation process facilitates the rapid clearance of bacteria from the circulation (within 30 min). We used *Vibrio campbellii* bioengineered to express green fluorescent protein (GFP), allowing us to better visualize the interaction between hemocytes and bacterial cells. Hemocyte responses were viewed in real time with a fluorescent microscope equipped to do time-lapse videography. Images were taken at set time intervals to determine the sequence of events involved in the hemocyte aggregation process both in the presence and absence of bacteria. Bacterial cells were observed both within individual hemocytes as well as inside hemocyte aggregates after bacterial exposure. Our experiments suggest that there is an apparent relationship between the hemocyte response to bacteria and the hemolymph clotting mechanism.

182 - Significance of Native Plantings for Insect and Pollinator Biodiversity

Kaitlin Campbell[1], Damien Dean[1], Destiny Robinson[1], Elisha Long[1], David Wimert[2], Rita Hagevik[1]

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Insect biodiversity is essential for functioning ecosystems. Recent studies have documented decreased biodiversity of insects and native bees, which were the main pollinators in North America before the arrival of the honey bee. In a collaboration with local middle schoolers and UNC-Pembroke, we conducted a project that looks at the fate of native bees and other insects by examining their diversity in two different types of landscapes. Insect diversity was measured in an urban landscape next to a wooded area and a natural landscape containing native plants also located next to a wooded area. Insects in this project were collected with the utilization of both pan traps and hand-netting. Our hypothesis is that there will be a greater diversity of native bees within the natural landscape than in the urban landscape and higher abundance of insects, showing that if areas are left undisturbed it may create a habitat that is conducive for the survival of native bees and other insects.

183 - Analyzing Anthropogenic Effects on Meiofaunal Community Composition Using Metabarcoding

Douglas Johnson, Jeremiah JonesBoggs, Julian Smith, III

Winthrop University, Rock Hill, SC

Marine meiofauna are tiny representatives from most animal phyla that live between sand grains. Meiofaunal communities are strongly affected by two anthropogenic stressors: beach nourishment and tourist visitation. Traditional assessments of the meiofaunal community are slow, requiring taxonomic expertise and significant time. Accordingly, we have established community metabarcoding at Winthrop University, and have used it in a preliminary comparison of meiofaunal communities at two North Carolina beaches differing in degree of anthropogenic stress. Replicate sediment samples were collected from Iron Steamer Pier (ISP--high nourishment & tourist impact) and Bear Island (BI--minimal nourishment & tourist impact). Meiofaunal organisms were separated from the sediment, DNA was extracted from them, and ~520bp of the 18S rDNA was amplified from each organism in the sample. The amplicons were sequenced (MiSeq, 300bp PE). Our analysis used commands from QIIME and USEARCH. Our data (~8.5M sequences) were clustered at 97% OTUs. Each OTU was identified to the lowest taxonomic level possible and community diversity compared for the two sites. Yield of DNA was low, allowing analysis of only 19 of 21 samples. USEARCH was more efficient at selecting unique OTUs than was QIIME (2202 vs 90,168). Coarse differences in the two communities matched our earlier results from hand-counting--more nematodes in fine sediments (BI) and more harpacticoid copepods in coarse sediments (ISP). We found 97% similarity for our data too relaxed, as we recovered fewer platyhelminth OTU's than we have known species. Work now in progress has increased sample-size ten-fold to increase DNA yield and future analyses will cluster OTU's at 99% for a closer match between numbers of OTU's and expected number of species. Overall, we regard this method as a promising one for long-term monitoring of the meiofaunal community. *Supported by P20GM103499 (SC INBRE) from the National Institute of General Medical Sciences, NIH.*

184 - Attempting to use low cost radar to track honeybees

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Most harmonic radar tracking of insects uses radar units that generate very high power, in thousands of watts, or cost tens of thousands to hundreds of thousands of dollars. This study examined the feasibility of using a comparatively low-cost ($8000) RECCO radar unit, available for avalanche rescue use, generating one watt output power. As no commercially available tag for insects was available for this unit, we also attempted to develop a tag that was small and light enough for a honey bee to carry in flight that still allowed for adequate range of detection. The tag had to also be assembled inexpensively, as such, we used Schottky barrier diodes donated by Clemson University, silver plated copper wire salvaged from old computer cable shielding, and graphite cement and super glue for assembly and attachment. The smallest detectable tag had a wire antenna length of approximately 12 cm, and could be followed by radar from six meters. Attachment was very difficult as the glue often would not set before the bee moved, and any glue in the wing joints impacted the bee's ability to fly. It appears that harmonic radar tracking can be used for honeybee tracking on a much lower budget than has been used in the past, but technological limitations cause difficulties at this time.

185 - Working out the complicated relationship between the brown widow spider and its bacterial endosymbiont

Erin Hembree, Emily Knight, J. Scott Harrison

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The bacterial endosymbiont, *Wolbachia pipientis*, is a maternally inherited bacterium known to alter arthropod life history patterns (i.e., male-killing, feminization, induced parthenogenesis, nutrient acquisition, etc.). Life history studies of species harboring *Wolbachia* are therefore incomplete until the effects of the bacteria on the host are understood. We recently characterized an F-supergroup *Wolbachia* from the invasive brown widow spider (*Latrodectus geometricus*). The consequences of the symbiont on the spider's life history are unknown, but we have determined that the bacteria do not influence spider sex-ratios. We can also conclude that the spider-symbiont relationship is not obligate, as population infection frequencies range from 20% to 90% in the southeastern USA. One explanation for the observed variation in frequency of infected individuals is incomplete transmission from mother to offspring. The purpose of this study was to determine the level of *Wolbachia* heritability in the brown widow spider by addressing the following questions: 1) what is the frequency of infected offspring produced by an infected mother? and 2) is there variation in bacterial load among spiders and their offspring? We used polymerase chain reaction (PCR) and *Wolbachia* specific primers to detect *Wolbachia* in individual spiders. We tested for the presence of *Wolbachia* in 480 offspring produced by five infected females. All 480 offspring were infected indicating a 100% transmission rate. We used quantitative PCR (qPCR) to estimate relative load of *Wolbachia* among individual spiders and offspring clutches. Infected adults varied in the bacterial load as did offspring clutches. Preliminary data indicates that maternal load does not correlate with load of offspring clutches.

186 - Diversity and Distribution of Native Pollinator Species within Urban Habitats

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With the decline of *Apis mellifera*, the honeybee, additional pollinator concerns have arisen; such as, the extent of native bee abundance decline, life cycles, and habitat availability. Native bees are endemic pollinator species that evolved before the introduction of *Apis mellifera* into North America. In this study, native bee richness and abundance in human dominated landscape in three different flora systems; lawn, wildflower, and formal gardens were examined to identify community composition, and foraging preferences of native bees within these habitats. We hypothesize that the native bee populations will be more abundance and diverse in areas with high native flora abundance and diversity. Sweep net collections were taking from seven different locations on three different dates. Diptera, Coleoptera, Hemiptera, Lepidoptera, Hymenoptera specimens were identified and tabulated. Landscape locations were selected based on it being an ecological island of sorts as it's existed as a green space within landscape of concrete and brick. Diversity indices have been calculated for each floral system. Analysis have proceeded as follows; a Simpson index was performed in conjunction with several t- tests to compare the diversity of similar and dissimilar landscapes towards each other, in combination with a comparison of floral resources vs native bee abundance. These have shown statistical relevant supporting the hypothesis. Further analysis will be run on the ANOVA program to established further support of the data. The continuation of native bee research to further understand foraging, habitat requirements and life cycles is of the greatest importance because native bee populations continue to decrease nationwide. However, small islands of diverse native gardens may provide a refuge for native bee to populations in human dominated landscapes providing vital resources they need to thrive. Future research should be focused the source of native bees moving into urban floral resources.

187 - A comparison of habitat selection and cold tolerance of the invasive fire ant, *Solenopsis invicta*, in piedmont and montane regions of the Carolinas

Amanda Lafferty

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The red imported fire ant, *Solenopsis invicta*, is an invasive pest in the United States that has rapidly spread throughout the country since its first introduction to Mobile, Alabama in the 1930s. Within the past decade, some fire ant specialists have suggested that the spread of fire ants to higher-elevation areas in the southern Appalachians was unlikely. However, *S. invicta* has recently been observed in Macon and Jackson counties above 4000 feet in elevation. Indeed, working with biologists at the Highlands Biological Station and Highlands-Cashiers Land Trust, I have documented approximately 75 live fire ant colonies in the Highlands and Cashiers areas within the past several months. The presence of these invasive ants at relatively high elevations raises the question of the likelihood of their enduring persistence. For my MS thesis research at Western Carolina University, I explored possible behavioral and physiological adaptation of fire ants to high elevation environments. The project I conducted entails a comparison of habitat selection, cold tolerance, and fat content of fire ants collected along a gradient from piedmont to montane regions in the Carolinas, adapting techniques that have been developed for other invasive ant species that are now threatening high-elevation environments. This research will yield valuable information concerning a highly aggressive pest that has adverse effects on public health and the environment.

188 - Survey of parasites infecting *Hexagenia* (Ephemeroptera: Ephemeridae) nymphs from western Lake Erie

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Burrowing mayflies, *Hexagenia* spp. (Ephemeroptera: Ephemeridae), are important biomonitoring indicators of mesotrophic water quality. However, little research has been done on parasites infecting *Hexagenia* spp. nymphs and what role parasites may play in *Hexagenia* population dynamics. Therefore, the aim of our study is to catalog parasites of a population of burrowing mayfly nymphs from western Lake Erie, Michigan and to describe basic ecological information such as infection prevalence, parasite loads, host specificity, parasite distribution, and host-parasite population dynamics. Burrowing mayfly specimens were collected as part of ongoing biomonitoring studies and examined for parasites microscopically. Based on tentative morphological identifications, *Hexagenia* nymphs are infected with trematodes in the genus *Crepidostomum*, protists of the genera *Vorticella* and *Epistylis*, and an as-yet-unidentified nematode. Parasites will be molecularly characterized by sequencing appropriate genes. Results from the genomic analysis of burrowing mayfly nymphs show two species present in the samples: *Hexagenia limbata* (n=36; 78%) and *Hexagenia rigida* (n=10; 22%). We present current progress on molecular and ecological work.

189 - Investigation of a bivalve, *Pisidium sp.*, found at Blount Springs, Blount County, AL

Kayla McCormick, Annika Hepp, Johnson David A.

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We have discover a small bivalve in a lower-sulfur-content stretch of a spring flowing from a sulfur spring head at Blount Springs, Blount County, AL. In our preliminary analysis, a short 18S rRNA (nuclear) sequence showed 100% identity to Pisidium walkerii, which has previously not been reported from the southeastern U. S. Mitochondrial cytochrome c oxidase I

sequencing indicated greater divergence from known members of the genus Pisidium. We present further DNA sequence evidence here to clarify the identity of this novel bivalve.

190 - A survey of intestinal helminths of largemouth bass (*Micropterus salmoides*) in West Central Georgia

Devyn Seifert, Harlan Hendricks, Austin Strellner

Columbus State University, Columbus, GA

Parasite records of largemouth bass (Micropterus salmoides) are sparse in the Southeastern United States, including Georgia. This study examined the gastrointestinal tract of largemouth bass from two creeks in Muscogee County for the presence of helminths. Heiferhorn Creek has most of its reach surrounded by forests, while Lindsey Creek largely runs through areas of commercial/industrial and residential development. The cestode Proteocephalus ambloplitis and the acanthocephalan Neoechinorynchus cylindratus were found in bass collected from Lindsey Creek (n=18), though the prevalence of the cestode was low (28%). The gastrointestinal tract of bass from Heiferhorn Creek (n=15) was infected only by N. cylindratus. The prevalence of N. cylindratus in largemouth bass from the two streams was similar; however, the mean intensity was significantly greater in bass from Heiferhorn Creek. A chemical analysis was not conducted, but preliminary analyses suggests that the potential quality of the water of the two streams influenced the success of these intestinal parasites more than it did the susceptibility of the fish to infection.

191 - A New Species of Water Bear (Phylum Tardigrada) from Virginia?

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Tardigrades are microscopic, segmented, eight-legged arthropod relatives often found in mosses or lichens. Though tiny, these creatures can appear to be indestructible due to their ability to withstand harsh environments. *Diploechiniscus oihonnae*, a terrestrial tardigrade, is the only known species in its genus. Originally described in 1903 from Norwegian material as *Echiniscus oihonnae*, it was redescribed in 2016 from European samples. In 2017 we collected samples from Virginia of what initially appeared to be *D. oihonnae*. After careful morphological observation and measurements, we have observed several differences between European and Virginia specimens. The most significant difference was that Virginia specimens have spines in several places where *D. oihonnae* has filamentous appendages. This variation suggests that our Virginia specimens are not the same species as the European ones. Additional molecular data should allow a more definite conclusion. Preliminary analysis of images of museum specimens identified as *D. oihonnae*, collected in Georgia, suggests that they are the same species as in Virginia. We also plan to obtain the Georgia specimens for morphological analysis, as well as other museum specimens identified as *D. oihonnae* that were collected in California.

192 - Microanatomy of the genitalia of cosmetid harvestmen of the genera *Paecilaema* and *Eupoecilaema* from Central America

Victor Townsend,Jr.

Virginia Wesleyan University, Virginia Beach, VA

With over 700 described species, the Cosmetidae represents the second largest family of laniatorean harvestmen. The taxonomy of the Cosmetidae, however, is in serious need of revision, with most diagnoses of genera and descriptions of species based upon relatively few

superficial, somatic characters. Most species descriptions of cosmetid harvestmen published prior to the 1970's lack illustrations of male reproductive anatomy. Similarly, potentially informative characters based upon female genitalia remain largely unexplored. In this study, scanning electron microscopy was used to examine penis and ovipositor morphology for several known and a few previously undescribed species of harvestmen from the genera *Paecilaema* and *Eupoecilaema*. These harvestmen are common inhabitants of the leaf litter in the rainforests of Panama, Costa Rica, Belize and other Central American countries. Members of several large species of these genera have also been observed climbing vegetation in the understory. Specimens from Central America were collected in the field or obtained from loans from museum collections. Genitalia were dissected, sonicated, dehydrated, dried and mounted on aluminum stubs. After sputter coating (with gold), specimens were observed with a Hitachi S-3400VP SEM at accelerating voltages of 5-15 kV. Significant variation in the microanatomy of the penis (ventral plate, macrosetae, microsetae, glans and stylus) and ovipositor (number and shape of peripheral setae, surface texture) were observed. These results indicate that the genus *Paecilaema* is probably not monophyletic and is composed of multiple species groups. In contrast, species presently placed in the genus *Eupoecilaema* share many characters based upon reproductive morphology (male and female) and represent a lineage that is independent from *Paecilaema*.

193 - Species delimitation in scorpions endemic to the Santa Catalina Mountains, Arizona: reconciling morphological and molecular data

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Accurate species delimitation has obvious effects on our understanding of taxonomy and biodiversity, but it also has far-reaching implications in biological disciplines (e.g., ecology, biogeography, evolution, conservation) that use "species" as the basic units for analysis. Scorpions belonging to the Vaejovis vorhiesi species complex are widely distributed throughout the southwestern United States and northern Mexico but the species are morphologically homogeneous and can only be reliably identified based on location (i.e., nearly every species is endemic to a single forested "sky island" mountain range). Two members of this lineage (Vaejovis deboerae and V. brysoni), however, have been recently described from the Santa Catalina Mountains just outside of Tucson, Arizona. Due to the geographic proximity of their type localities and their morphological similarities, we used morphometric and genetic data to test whether these two nominal species are indeed distinct. Results from the morphometric data suggest that the features used to distinguish these species are unreliable and that there is only a single species in the Santa Catalina Mountains; however, the genetic data show that there are two genetically divergent lineages that overlap at the type locality of V. deboerae. In the absence of genetic data from the holotype of V. deboerae, the taxonomic status of these scorpions remains elusive but raises a number of new questions regarding the evolution of body size and genetic divergence along elevational gradients in non-vagile arthropod taxa. This research further underscores the importance of developing rigorous sampling strategies and implementing integrative approaches for species delimitation in taxonomic studies of morphologically cryptic groups.

194 - Genetic Variability within and among Species in the Tardigrade Genus *Milnesium*

Martha Tsaliki, Kathy Jackson, Harry Meyer, Juliana Hinton

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Tardigrades are microscopic animals related to arthropods. Terrestrial species are often found in mosses and lichens. Classically, tardigrade species have been identified and distinguished using morphological data; recently molecular data have become increasingly important.

Milnesium lagniappe Meyer, Hinton and Dupré, 2013 was first collected from moss in Calcasieu Parish, southwestern Louisiana, where it is widely distributed. Based on morphological criteria, specimens from Fort Myers, Florida have also been identified as *M. lagniappe*. The aim of this study was to collect molecular data on *M. lagniappe* to determine the level of genetic diversity within the species, and compare it to other *Milnesium* species. We examined the internal transcribed spacer region (ITS2), which has a fast rate of evolution and should allow for differentiation between closely related species. DNA isolated from seven Louisiana *M. lagniappe* was analyzed and was between 99.3-100% identical over a 443bp region of ITS2. However, the ITS2 region of *M. lagniappe* is only 76% similar to *M. variefidum* (from Scotland), 73% similar to *M. berladnicorum* (Romania) and 72% similar to *M. tardigradum* (Germany). We plan to sequence DNA from Florida *M. lagniappe* specimens to compare them to the Louisiana population.

195 - Assessment of the nematocidal properties of naturally derived acetogenins

Janelle Chuah, Takashi Suyama, Marietta Wright, Wayne Rossiter

Waynesburg University, Waynesburg, PA

Acetogenins represent a class of natural compounds that have proven medically important in the treatment of cancer, and are suspected to have anthelmintic properties in the treatment of infectious diseases. These compounds are produced in members of the plant family, Annonaceae, which includes the pawpaw tree (Asimina triloba). In this study, we assess the effects of acetogenins on the behavior and survivorship of nematodes using C. elegans and L3-stage strongylids. Acetogenins were extracted from herbal capsules manufactured by Nature's Sunshine ®. As a preliminary test, the acetogenins were tested on C. elegans (N2) provided by the Caenorhabditis Genetics Center (CGC). The nematodes were cultured on NGM plates inoculated with E. coli (OP50). To better assess the potential anthelmintic effects, the extract was introduced to plated L3 strongylids nematode larvae, acquired from a local organic cattle farm and isolated from cattle fecal mats. Nematodes were exposed to acetogenins dissolved in DMSO, and observed for viability and movement over a 48-hour period (experimentation pending). Because acetogenins are known to be potent inhibitors of the mitochondrial (complex I) and cytoplasmic (anaerobic) ATP production, we hypothesize that they will negatively affect the nematodes' survivorship. Positive results will support the candidacy of acetogenins as anti-parasitic drugs in the treatment of nematode infections.

196 - A Survey for *Wolbachia* bacterium in biting midges

Heather Buske, Ariel Joy Lipat, Brian Kohler, Jennifer Zettler, Traci Ness

Georgia Southern University, Armstrong Campus, Savannah, GA

The purpose of this research is to survey the presence of the *Wolbachia* bacterium in *Culicoides furens*, a species of biting midges commonly called sand gnats, from different areas surrounding the southeast coast of the United States. This species was collected because it is one of just three most abundantly found in coastal Georgia. The bacterium *Wolbachia* is an intracellular endosymbiont that can manipulate its host's reproductive ability either through feminization, male killing, cytoplasmic incompatibility, or parthenogenesis. Because of this manipulation, the study of *Wolbachia* has been a focus in the control of mosquito populations known to be vectors that transmit harmful, if not deadly diseases. After conducting a literature review, it was found that many species of biting midges have also been identified as vectors that transmit disease to wild and domestic animals, so determining the presence or absence of this bacterium can provide valuable evidence to the scientific community for future studies. The methods employed in this research to survey for *Wolbachia* bacterium include: insect collection and identification, DNA extractions, Polymerase Chain Reaction (PCR), and gel electrophoresis. Specifically, samples were collected from Jasper County, South Carolina, and

Chatham and Bryan Counties, Georgia. All samples were stored and maintained within the Armstrong State University Biology Department. DNA extractions were performed using the QIAGEN DNeasy Blood & Tissue Kit according to manufacturer's recommendations. Traditional PCR was used to amplify both insect CO1 and *Wolbachia* 16S rRNA targets. Gel electrophoresis confirmed the presence or absence of *Wolbachia* 16S rRNA bands. To date, 36 samples have been tested and all have been conclusive for the absence of *Wolbachia*.

197 - Determining the Prevalence of *Wolbachia* in Thrips in Coastal Georgia

Ariel Joy Lipat, Brian Kohler, Heather Buske, Traci Ness, Jennifer Zettler

Georgia Southern University, Armstrong Campus, Savannah, GA

The purpose of this research was to survey and determine the prevalence of *Wolbachia* in members of Order Thysanoptera, Family Thripidae (more commonly known as thrips). These insects are pests that are vectors of various plant topoviruses affecting many agricultural crops. They are common throughout most regions of the United States and have approximately 6000 species described globally. Their populations are largely female and have the ability to reproduce in the absence of males. *Wolbachia* is a vertically transmitted endosymbiotic bacterium that is known to increase female offspring through a variety of mechanisms in different insect species. In this study, thrips were collected in the Savannah, GA area and tested for the presence of *Wolbachia*. Thrips were collected, stored in vials filled with 70-80% alcohol, and frozen at -20C. When possible, specimens were identified to the species level (e.g. *Frankliniella bispinosa* and *F. tritci*). DNA extraction, PCR, and gel electrophoresis were used to screen for the presence of *Wolbachia* in individual specimens. To date, over 60 individuals have been collected from 10 locations in Chatham and its surrounding counties. Approximately 67% of all thrips specimens were positive for *Wolbachia* compared to the 20% infection rate noted in other studies for all insects. Future studies will determine if there are any differences in the prevalence of *Wolbachia* between species.

198 - Prevalence of *Wolbachia* in Local Populations of Cockroaches in the Southeastern US

Brian Kohler, Ariel Joy Lipat, Heather Buske, Traci Ness, Jennifer Zettler

Georgia Southern University, Armstrong Campus, Savannah, GA

Wolbachia is a bacterium that infects the reproductive organs of approximately 20% of insect specimens. Yet, preliminary surveys of cockroach populations in coastal Georgia show that approximately 40% test positive for *Wolbachia*. The purpose of our study is to determine if the prevalence of infection in cockroaches varies by species and/or by their locations. Our project involves a large-scale survey of cockroach species in Chatham County and the surrounding areas to more effectively determine the rate of *Wolbachia* infection in regional populations. Cockroach specimens were collected, stored in vials filled with 70-80% alcohol and kept frozen at -20°C. Then, we used the combined procedures of DNA extraction, PCR, and gel electrophoresis to determine infection rate. To date, over 150 individuals from 11 species from 3 families have been collected from 14 locations. Of those tested, cockroaches in the family Ectobiidae had the highest prevalence of *Wolbachia*. Specifically, we found that nearly 100% of German (*Blattella germanica*), Asian (*B. asahinai*), and Least Yellow (*Cariblatta minima*) cockroaches tested positive for *Wolbachia*. Both male and female representatives in other families harbor *Wolbachia* but not at comparable levels. For example, 7% of Smokey Brown (*Periplaneta fuliginosa*), 12.5% of American (*P. americana*), and 20% of Florida Woods (*Eurycotis floridana*) cockroaches had the bacterium. *Wolbachia* was absent in all Surinam (*Pycnoscelus surinamensis*) specimens tested. Future studies should investigate why the prevalence of *Wolbachia* is atypically high in species in the family Ectobiidae. Understanding prevalence and the symbiotic role of *Wolbachia* in cockroaches can help determine control mechanisms for these peridomestic insect pests.

199 - Preliminary survey of the parasites of Mayan Cichlid, *Cichlasoma urophthalmus,* from southern Florida

Cristina Garcia, Riccardo Fiorillo

Georgia Gwinnett College, Lawrenceville, GA

We surveyed the helminth parasites of the Mayan Cichlid.

200 - Stressed with pests: Can landscape design be used as a tool to reduce pests on urban trees?

Sarah Parsons, Steve Frank

NC State University, Raleigh, NC

Trees provide many ecosystem services in our urban environments. However, city trees are often stressed by pests and hot urban temperatures. Our research evaluates the mechanisms driving both pests and their natural enemies on city trees and explores how identifying these mechanisms may be used to inform landscape design and improve urban tree health. This research will test a well-known ecological concept, the enemies hypothesis, in a space that has not be thoroughly explored - the city. To test our hypothesis that the urban habitat can be locally manipulated to decrease pests on urban trees, we have collected data on 33 crape myrtle trees in Raleigh, NC. Over the course of two years, we have measured vegetation complexity around study trees, quantified impervious surface cover among other urban habitat elements, and collected pests and natural enemies on trees. We have found in keeping with previous urban ecology studies that impervious surface is a strong driver of crape myrtle aphid pest abundance. With an increase in impervious surface cover within 100m of crape myrtle trees, aphid abundance increases. Encouragingly, however, we have also found that local vegetation elements around crape myrtles in the landscape have some effect on natural enemy abundance. Community multivariate analysis has also shown that some species of natural enemies respond differentially to various urban habitat variables. Together these findings suggest that although the impervious nature of our cities is favorable to pests, local landscapes around trees may be manipulated to attract certain species of natural enemies and help regulate pest populations. Results from this study could be used to help inform landscape design for city landscape practitioners, reduce pests on urban trees, and improve city tree health.

201 - Habitat use and home range of Eastern Box Turtle (*Terrapene Carolina)* in North Georgia Piedmont

Jessica Martin, Samantha Shea, Jennifer Mook, Natalie Hyslop

University of North Georgia, Oakwood, GA

Eastern Box Turtles (*Terrapene carolina*) are native to the Eastern United States ranging from New Hampshire to Georgia. The species is experiencing range-wide population declines and is classified as vulnerable by the International Union for the Conservation of Nature. Despite the species' status, little research has been conducted regarding home range and habitat use in the Southeastern U.S. To help contribute to the knowledge of the species in this region, we have conducted a radiotelemetry study since 2013 to investigate factors that influence *T. carolina* movement, survival, and habitat use in the Northeastern Piedmont region of Georgia. The study site has mixed hardwood-pine uplands primarily comprised of oaks and maples; mesic and upland areas dominated by Chinese privet (*Ligustrum sinense*); beaver-created wetlands; and maintained utility line areas. Turtles were tracked on foot by homing up to 2 times a week from May 2013 to October 2017. We collected an average of 61 radiolocations (range: 2 to 176) per turtle (n = 19 males, 9 females). Home ranges (100% minimum convex

polygon) varied from < 1 to over 10 ha. Radiotracked turtles primarily used mixed-upland areas and regions dominated by *L. sinense.*

202 - The Gopher Tortoises, *Gopherus polyphemus*, of Cumberland Island, Georgia: Daily Activity Patterns and Temperature Regulation.

John Enz[1], Alexandria Gagne[1], David Unger[2], Reeve Hunter Moore[2]

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Due to habitat loss, urban sprawl, and over-exploitation, the land-dwelling Gopher tortoise (*Gopherus polyphemus*) is now listed as a Threatened species in much of the southeastern United States. Gopher tortoises are considered a "keystone" species, mainly because the burrows they dig provide shelter for numerous other species as well the tortoises themselves. Therefore, any information regarding the current status, distribution, density, behavior, and impacts that may affect this species is critically important to the long term viability of the species and is particularly important for isolated, remnant populations such as the population of Gopher tortoises on Cumberland Island, Georgia. The purpose of this study was to delineate the daily activity patterns and preferred temperatures for out of burrow activity for the largest pod of tortoises in the central portion of Cumberland Island. To accomplish this goal, field observations, along with motion activated game cameras and radio transmitters, were used to track and record the gopher tortoise behavior of the largest pod on Cumberland Island during the summers of 2016 and 2017. Preliminary results from a dozen tortoises will be given that show a marked difference in daily activity patterns when compared to other similar studies performed on mainland tortoise populations. In contrast on Cumberland Island, tortoises seem to prefer the hottest temperatures of the day to exit the burrow, forage, and search for mates. This population continues to be studied.

203 - Alligator Snapping Turtles (*Macrochelys temminckii*): Where are they now in Western Tennessee?

Lewis Recker[1], Kristen Cecala[2], Saidee Hyder[1], Josh Ennen[3], Dustin Garig[1], Rob Colvin[4], Jeremy Denison[4], Andrew Feltmann[1], Madison Herrboldt[1], Caitlin Weible[1], Taylor Simmonds[1], Jon Davenport[1]

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The Alligator Snapping Turtle (Macrochelys temminckii) is the largest freshwater turtle in the United States and is distributed within the Mississippi and Gulf Coast river drainages reaching as far north as Iowa. Alligator Snapping Turtles are apex predators in these drainages but have experienced dramatic declines throughout their range due to overexploitation. Despite the type locality from West TN, very little distribution and demographic information is available from this part of their range. From 1992 to 2005, Tennessee Wildlife Resources Agency (TWRA) released 444 Alligator Snapping Turtles into West and Middle Tennessee river drainages. Unfortunately, no data is available determining the success of those introductions. From 2016-2017, we surveyed four West TN drainages to assess the abundance and distribution of Alligator Snapping Turtles. A total of approximately 40 sites were trapped with baited hoop nets of various sizes. During the two years of sampling Alligator Snapping Turtles were only detected in 2 of the sites. Preliminary analyses of occupancy for Alligator Snapping Turtles suggests that detection probability may be affected by trap size. In addition, the occupancy rates of other turtle species appear to be affected by trap size. In the future, we plan to analyze habitat variables that may also affect occupancy rates and detection probabilities along with additional years of trapping data.

204 - Postural adjustments influence water balance in green salamanders, *Aneides aeneus*

Paul Cupp

Eastern Kentucky University, Richmond, KY

Green salamanders, *Aneides aeneus*, are known to occur in crevices of rock cliffs that are humid but not wet. Postural adjustments and a high tolerance to desiccation or critical activity point (CAP) allow *A. aeneus* to respond to changes in moisture conditions that may arise in home or transcient crevices. A high CAP of 36.7% found in *A. aeneus* from southeastern KY combined with inherent behavioral adjustments such as coiling of the body, aligning the tail along the body and flattening the body to the substrate all reduce body surface exposure and slow the dehydration rate and extend the time to reach CAP. During drought or dry conditions, *A. aeneus* may remain in home crevices longer and forage from crevices for short periods. A high CAP may allow them to tolerate some loss of body water (8-15%) which may be rehydrated as humidity levels rise overnight and some water condenses on rock cliffs. Also, conditions of extended rainfall resulting in water standing in crevices may subject some *A. aeneus* to overhydration. In ten instances (equally divided in lab and field), individual adult *A. aeneus* were observed in postures where the limbs were raised high and the head and tail were raised off the substrate thereby significantly reducing exposure ot the skin to wet substrates. One salamander shifted to an alternate posture in which all four feet were in contact with the substrate with limbs extended, and the mid-body arched above the substrate. Slight changes in posture may provide for fine control of dehydration or rehydration rates to optimize body water economy or content. Postural adjustments may allow terrestrial salamanders, such as *A. aeneus*, to remain in home crevices thereby reducing exposure to predation.

205 - Testing for Introgression and speciation in Seepage Salamanders *(Desmognathus aeneus*)

Henri Vega-Bernal, David Beamer

Nash Community College, Rocky Mount, NC

Seepage salamanders, are amongst the tiniest vertebrates in North America and are one of the smallest species of the genus *Desmognathus* (less than 60mm in length). With concomitant small home ranges (typically less than 1 m^2), they are distributed across a vast geological region, ranging from the Appalachian mountains of western North Carolina, southwest into Alabama. Because these factors provide the geographic and evolutionary context for diversification, we wanted to test whether there is strong genetic structure across the range. Seepage salamanders are currently recognize as a single species, however we present a phylogenetic reconstruction based on mitochondrial DNA sequence data for ~60 populations, which suggests there are five distinct clades within seepage salamanders. We collected an additional 400 genes for nine populations and use this data to test for introgression between lineage and to test for the presence of multiple species within seepage salamanders.

206 - The brighter the better: Does throat color predict morphometric traits linked to fitness in Green Frogs?

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Vocalizations clearly play a significant role in territory defense and mating success in many frogs and toads. Conversely, the extent to which visual signals are important to social behavior is poorly known for most anurans, despite the fact that many species of frogs exhibit colorful

skin patches that could conceivably function as badges in social contexts. In addition, frogs have excellent color vision even under low light conditions, suggesting that many species, even those active primarily at night, could make use of visual signals accordingly. Consequently, the possible importance of body coloration to sexual selection in anurans deserves increased attention. The Green Frog (Lithobates clamitans) is a common ranid of a variety of aquatic environments in the eastern US. Males are highly territorial and employ vocalizations during mating and other social contexts. In addition, adults exhibit sexually dimorphic coloration: males express bright yellow throats whereas females have white throats, though any role for this feature in mating success is unknown. As a first step to addressing this deficiency, we will test the hypothesis that coloration of the throat or other features is related to variation in traits linked to fitness in anurans. In April 2018, we will capture 40 adult male and female Green Frogs (N=20/sex) from a known population near Jackson, Georgia and measure coloration of the throat, dorsal abdomen, and ventral abdomen using spectrophotometry. We will then measure a variety of morphometric traits in each frog, including body length, mass, head size, forearm and hindlimb length, forearm and hindlimb width, and dorsal spot number and size. If throat color serves as a signal of quality in either sex, we predict that variation in throat color will be correlated with variation in one or more measured morphometric traits.

207 - The Development of a DNA Barcode Assay to Detect Green Salamander from eDNA

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Green Salamanders, *Aneides aeneus*, are the only member of the genus *Aneides* found in the eastern United States. The Green Salamander's true distribution and status are unknown across much of its range. Due to its use of deep rock crevices as refugia, it is difficult to detect with most traditional herpetofaunal survey methods. The purpose of this study was to develop a method of detection that would use eDNA to specifically detect Green Salamanders. This test was developed using samples collected from the Cumberland Mountains in southwestern Virginia, an area harboring an unusually abundant population of the species. The size of this population offers a unique opportunity to gather eDNA samples that otherwise would be difficult to attain. Sequences for *nd4* and *cytB* were retrieved from GenBank and primers designed to specifically target Green Salamander DNA. Primers were tested against Green Salamander DNA, as well as Slimy Salamanders *(Plethodon glutinosus*), another species that occupies rock crevices at our sampling sites. It was found that *nd4* was the better target sequence since it produced the least ambiguous results and deep sequencing of the *nd4* amplicon showed that only Green Salamander DNA was amplified from environmental samples. PCR conditions have been optimized and this primer set can be used as a binary test to detect the presence of A. aeneus by using qPCR. This has been tested by utilizing samples found in our study area, as well as samples from rock outcrops collected outside the Green Salamander's range. To date, the false positive rate was 0% and the positive rate of detection was 84.6%. This test will allow for a broader and less field intensive sampling that may enhance researchers

208 - Behavioral Thermoregulation and Social Effects on *Gopherus polyphemus* Growth Rates

Julie Cobb

Georgia Southern University, Statesboro, GA

The regulation of an ectotherm's internal body temperature (T_B) is highly dependent on the ambient temperature (T_A) of their environment. By performing certain behaviors, ectotherms are able to fluctuate their T_B around a set point to maximize growth rate. Nests were collected from the field on 20 August 2016 from Fort Stewart and George L. Smith State Park in

southeast Georgia. Egg incubation was completed in the lab. Hatchling sex was already established in the field during the month of July prior to the eggs being brought into the lab. Forty-eight tortoises were separated into two groups with 24 tortoises in each section. Sections were divided into two social groups containing three tortoises (two females and 1 male) per enclosure and two isolated groups (one male or female). The social and individual groups were further distributed into groups with supplemental heat (heat rocks) to stimulate thermoregulation and those without supplemental heat (no heat rocks). The tortoises' growth rates were measured bimonthly with six measurements; straight carapace length, width, depth, mass, plastron minimum and maximum beginning on 18 July 2017. Temperature and behaviors were recorded twice a week. The tortoises were fed weekly on a mixed greens diet with Mazuri tortoise diet supplemented once a month. Sex was confirmed via laparoscopy at one year of age. This study will conclude in the spring of 2018 and the tortoises will be released back to their respective habitats. Experimental design and preliminary results will be presented. At the conclusion of the study, tortoises placed in an isolated enclosure with heat rocks are expected to have increased the greatest in size relative to the other groups.

209 - Using Genomic Data to Test for Monophyly in *Pseudotriton* and *Gyrinophilus*: A Range Wide Survey

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Nash Community College, Rocky Mount, NC

The red and mud salamanders (*Pseudotriton*) and spring salamanders (*Gyrinophilus*) are brightly colored salamanders broadly distributed throughout the Eastern United States. Each species is currently represented by four subspecies. The monophyly of *Pseudotriton* with respect to *Gyrinophilus* has recently been called into question. In order to reconstruct the evolutionary history of these salamanders, we collected sequence data from 400 loci from 15 individuals sampled across the distribution. This data strongly supports the monophyly of *Pseudotriton* and a sister relationship between *Gyrinophilus* and *Stereochilus*. Using our phylogenetic reconstruction of the 400 gene data set as a baseline we have sampled ~1000 bp fragment of an mtDNA gene (ND2) from 85 populations of *P. ruber*, 24 populations of *P. montanus,* and 28 populations of *G. porphyriticus*. We used a Bayesian phylogenetic reconstruction of our mtDNA data set to understand the within species diversification. We find limited support for the currently recognized subspecies of all three species. However, our mtDNA analyses do reveal the existence of genetic breaks that are not recognized by previous taxonomies.

210 - Relationship between amphibian diversity and wetland condition based on a rapid assessment method in western Kentucky

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Kentucky has seen a serious decline in the quantity and quality of its wetlands over the past century. Efforts to efficiently assess the condition of remaining wetlands has been developed in the form of the Kentucky Wetland Rapid Assessment Method (KY-WRAM). RAMs represent valuable tools for monitoring anthropogenic disturbances to wetlands and wetland condition, but require validation in the form of independent biological assessments. By linking biological communities to measures of disturbance it is possible to verify the extent to which the RAM represents substantive changes to wetland habitats. In areas with diverse amphibian communities, changes to habitat can influence the presence of certain species. We used amphibian assemblage data gathered from across a wetland condition gradient in western Kentucky to assess the validity of the RAM in capturing the types of disturbance that impact amphibian communities in that region. Past amphibian research from other Kentucky regions

that utilized the KY-WRAM found a significant positive relationship between amphibian species richness and wetland condition. Preliminary results of data from far western Kentucky show that this relationship may be inverted in this region. Wetlands in western Kentucky are subject to different land-use impacts, such as widespread coal mining in the western Green River Basin and the effects of large scale flooding near the Mississippi and Ohio rivers. A large proportion of far western wetlands experience multiple high-volume floods per amphibian breeding season. This flooding impacts the ability of amphibians to breed in large sections of high condition wetlands and lowers measured species richness. Understanding why this negative trend emerges in this area will be important if the KY-WRAM is to be inferred to have a predictable relationship with amphibian richness statewide.

211 - Preliminary investigation of mercury concentrations in three freshwater turtle species of West Tennessee

Taylor Simmonds[1], Saidee Hyder[1], Madison Herrboldt[1], Caitlin Weible[1], Dustin Garig[1], Andrew Feltmann[1], Rob Colvin[2], Jeremy Denison[2], Josh Ennen[3], Rebecka Brasso[4], Jon Davenport[1]

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Mercury is a heavy metal that bioaccumulates in a variety of organisms, causing physical and neurological effects. Turtles are one group of organisms that bioaccumulate mercury in their tissues and some species (*e.g., Chelydra serpentina*) are used as biomonitors of mercury. In general, turtles are model organisms for studying bioaccumulation of heavy metals largely because of their longevity. In this study, we focused on three species of turtles, the red-eared slider (*Trachemys scripta),* the common snapping turtle (*Chelydra serpentina)*, and the alligator snapping turtle (*Macrochelys temminckii*), to determine mercury concentrations in West Tennessee turtles. To achieve this goal, a total of thirteen sites were sampled across West Tennessee from March to July 2017. Blood and toenails were taken from the back feet of each captured turtle and analyzed in a Nippon MA-3000 Direct Mercury (Hg) Analyzer. We found that all species sampled had a significant level of mercury in their toenails, and there was significant difference in mercury levels between species. Secondarily, we found that some turtle species have potentially higher mercury levels than the EPA recommended consumption level for freshwater fish.

212 - Ranavirus Distributions in North America: Examining the Utility of Databases and the Literature

Leigha Henson, Joyce Klaus, Nicole Vanderbush, Amanda Duffus

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Ranaviruses are globally emerging infections of amphibians, fish, and reptiles. They are wide spread in the continental United States and are responsible for many morbidity and mortality events each year. Despite being defined as a reportable infection in amphibians by the World Organization for Animal Health (OIE), there are few tools that actively track *Ranavirus* infection. In the USA, there are three widely available resources used to report and track *Ranavirus* infections. One way to track infections is by searching scientific literature, which is cumbersome to navigate and may not be accessible. Another method to track infections is by using the Wildlife Health Information Sharing Partnership event reporting system (WHISPers) database run by the USGS National Wildlife Health Center. WHISPers is an online searchable database that is populated with wildlife morbidity and mortality events of all sorts from across the USA that have been studied by USGS. The third way to track infections is by using the Global Ranavirus Reporting System (GRRS), which is an online searchable database that is currently specific to *Ranavirus* infections in all affected species. The GRRS is a new tool with

data populated by scientists and predominantly based on published accounts of *Ranavirus* infection, morbidity, and mortality events around the globe. Currently, the majority of reports in the GRRS appear to come from the USA. Here we compare the relative utility of each data source for tracking amphibian and reptilian *Ranavirus* infections in the USA. A major failing of the online databases is that they typically are a few months behind when compared to the more cumbersome task of sorting through the literature. However, they provide a quick reference and starting point for more in depth questions.

213 - Calculating Differences in the Home Ranges of Eastern Box Turtles

Amy Kish, Dr. John Roe

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Eastern box turtle populations have been declining across their range. Considered threatened in many of their native areas, understanding their ecology and behavior is critical to their persistence. As part of a multi-year year study in North Carolina, eastern box turtles at both Weymouth Woods Sandhills Nature Preserve (WEWO) and Lumber River State Park (LRSP) in the Coastal Plain have been radio tracked to examine variation in home range size between sexes and variation between populations that differ in exposure to prescribed fire. Terrestrial turtles are expected to be at high risk from prescribed fire, yet we have little knowledge of their responses. We tracked 29 turtles at LRSP (14 females/15 males) and 36 turtles at WEWO (18 females/18 males) and recorded locations weekly. We then used GIS to map locations and estimated home range sizes using the minimum convex polygon (MCP) and kernel density methods using Geospatial Modeling Environment (GME) software. Females at both locations had larger home ranges than males, 60% larger at LRSP and 73% larger at WEWO. Turtles at WEWO also had smaller home ranges with females 45% less and males 59% less than turtles at LRSP. Kernel density home range estimates were nearly double that of the MCP. Females likely traverse larger areas to seek suitable nesting locations, which often requires long-distance movements to areas far from other activity centers. We suspect that the smaller home range sizes of turtles at WEWO could be due to many factors, including the limited availability of water resources, their selection of limited mesic hardwood forests, and perhaps also as a behavioral mechanism to avoid injury and mortality from fire. Land managers can use these findings to better plan for box turtles in prescribed fire and other management practices.

214 - Seasonal Activity and Site Fidelity of Green Salamanders (*Aneides aeneus*) in Virginia's Appalachian Plateau

Peter Nauss, Walter Smith

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The Appalachian Mountains are a peak hotspot for salamander biodiversity. Among this diversity, the green salamander (*Aneides aeneus*) is the only species of its genus native to the eastern United States. It is commonly found in rock formations within moist deciduous forests. Green salamanders are thought to be rare and declining across much of their range, but field survey protocols for the species are impeded by a lack of knowledge about its movement and activity patterns. We used one hundred randomly-selected rock crevices from an abundant Green Salamander population in Wise County, Virginia to monitor salamander movements weekly over the course of the 2017 active season. Salamander detection was assessed as a function of microclimatic variables, season, and time of day. Our results showed that time, temperature, and dewpoint all had a significant influence on the total number of salamanders encountered, with salamanders actively dispersing from rock outcrop refugia during more humid conditions and periods of milder temperatures. Salamander detection in rock crevices also peaked during early morning hours, which is likely due to salamanders returning to crevice refugia following nocturnal foraging activities. Our findings may assist researchers in

developing survey protocols that maximize detection by visiting rock outcrop sites during periods when salamanders are most likely to be attending crevice openings and encountered through visual survey methods.

215 - Herpetological Assemblages Along Riparian Habitats of the Azuero Peninsula, Panama: An Assessment of Successful Restoration

Tyler Kovacs, Heather Griscom

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Tropical dry forests are one of the most endangered tropical ecosystems on earth. In Panama, this ecosystem has been almost completely eliminated due to a long history of deforestation for agriculture, timber extraction, and cattle grazing. This land is becoming increasingly abandoned due to changes in socio-economic factors and declining productivity. Reforestation of this land is becoming increasingly important to restore this ecosystem's health and biodiversity. Reforestation has been increasing within the past 20 years, however most are exotic tree plantations, which may not support native floral and faunal communities. Biodiversity of species that are susceptible to environmental change, like amphibian and reptiles, serve as bioindicators of a healthy ecosystem. Herpetological assemblages will be examined at four different locations to determine if reforestation sites support the recovery of herpetological communities. Two of these sites represent the extreme ends of the disturbance spectrum. The most disturbed site is an active cattle pasture, and the least disturbed site is comprised of an 80+ year old secondary forest. Two additional study sites represent reforested land that has been protected from cattle and fire for 15 years. One is an exotic teak planation (monoculture) and the other was allowed to regenerate. Habitat and vegetation characteristics will be investigated to determine which factors support the recovery of these communities. The results will identify the amphibian and reptile species present and relative abundances within these communities to be able to compare restoration success. This will help guide future reforestation projects of tropical dry forest ecosystems.

216 - Differential Habitat Use by Sympatric Salamanders along their Parapatric Border

Cecilia Davis, Tyler Brock, Jessica Smith, Carlos Camp

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Cryptic species with similar niches are often distributed parapatrically. Competition theory predicts niche partitioning in the sympatric zone of contact between species. We tested this prediction with two cryptic, parapatrically distributed two-lined salamanders (*Eurycea cirrigera* and *E. wilderae*) along their contact zone in northeastern Georgia. Three different stream sites were chosen where the two species occur together, and at each stream upland versus lowland habitats were analyzed. We measured stream-bed width, stream depth, flow rate, substrate, temperature, and presence or absence of beaver activity. Two-way ANOVAs were run for bed width, depth, and flow rate. A Mann-Whitney was used to test for difference in substrate between upland and lowland at each site. We ran a pairwise analysis of temperature at each site across the span of one year. PCR was used to identify approximately twenty larvae from each habitat at each site. We ran a contingency analysis to test for random distribution of species between upland and lowland sites. The ANOVAs for both bed width and flow rate indicated significant differences between habitats and among sites with a significant interaction. The ANOVA for depth indicated a significant difference between habitats and a significant interaction but no significant difference between locations. Mann-Whitney showed a significant difference between habitats in substrate at two of the three sites. The pairwise analysis in temperature showed no difference between habitats at any site. Beavers were active at all lowland habitats but at none of the upland. Contingency analysis found a significant difference in species distribution between habitats at all three sites. In conclusion,

these two species occupy different habitats when in sympatry. The choice of habitats reflects upland versus lowland distributions across physiographic regions of the two species with *E. wilderae* located in the mountains and *E. cirrigera* across the Piedmont.

217 - An investigation of a salamander community associated with a Northwest Georgia first order stream

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[1]Dalton State College, CALHOUN, GA, [2]Dalton State College, Dalton, GA

A survey of the salamanders within a protected section of creek on the Dalton State College campus was conducted to characterize the creek amphibian community. Sampling took place within and around the creek from April-December 2017. The section of creek sampled is located above campus proper within a managed trail system maintained by the school. Sampling was conducted using three methods of capture: funnel traps, coverboards, and timed dip-netting. Three sizes of funnel traps were used: 0.7 L, 1 L, and 2 L. Eighteen funnel traps were placed in the creek in either a pool or riffle. The depth of the pool or riffle was measured for each trap and recorded. Ten coverboards were placed at varying distances from the creek bank. Timed dip-netting was conducted each sample day for twenty minutes after traps were checked. Morphometrics were recorded for each specimen. Each specimen was uniquely marked via toe-clipping for recapture recognition. Species captured included: Desmognathous spp., Eurycea cirrigera, and Psuedotriton ruber. Catch per unit effort, relative abundance, and weather condition data were obtained. Desmognathous spp. was found to be the most abundant, and made up the majority of the 79 total salamanders sampled. We plan to continue this research into 2018.

218 - Movements of Anurans in Palo Verde Between Wetland and Mountainous Habitats During Breeding Season

Amy Williams, Danielle Satre

Reinhardt University, Waleska, GA

Anurans that live in tropical dry forests such as those in Palo Verde National Park in the Guanacaste Province of Costa Rica depend on the tremendous rainfall associated with the wet season, which begins in late May. As a result of the rainfall during this time, pools of water form in low-lying regions, providing spaces for the anurans to lay their eggs, which helps to secure continuation of the species. These “wetlands” draw in many anurans during the breeding season, and many of them emerge at nightfall to forage. Therefore, it was hypothesized that higher species diversity, and a higher proportion of females, would be found near the wetland region than the mountainous region during the mating season. The data shows that there was indeed a larger proportion of females on the wetland side of the barrier, suggesting that there were more females than males moving from wetland to mountainous habitats. The data also shows that there was greater species diversity on the wetland side.

219 - Taxonomic Perspective of *Eurycea guttolineata* and *Eurycea longicauda* Based on Mitochondrial DNA Sequence Data

Tyler Scott[1], Alan Babineau[2], David Beamer[1]

[1]Nash Community College, Rocky Mount, NC, [2]East Carolina University, Greenville, NC

The Three-lined Salamander (*Eurycea guttolineata*) is a moderate sized salamander endemic to the Southeastern United States from Eastern Virginia southwest to the Mississippi River, making a horseshoe pattern around Central Tennessee. The Long-tailed Salamander (*Eurycea longicauda*) is also a moderately sized salamander but whose range is vastly larger, spanning

from New York west to Illinois (with some populations being found west of the Mississippi River), and southward to Northern Alabama. *E. guttolineata* and *E. longicauda* are currently treated as separate species, however in the recent past the three-lined salamander was considered to be a subspecies of *E. longicauda*. The most recent taxonomic treatment used both morphology and allozyme data to support species status for *E. guttolineata*. In that work all specimens examined from the putative zone of intergradation were allocated conclusively to *E. longicauda*. Here we present the results of a phylogeographic survey across the range of *E guttolineata*. Our phylogenetic reconstruction based on an ~850 bp of a mtDNA gene (Cyt-b) is characterized by surprisingly limited genetic diversity. These results suggest either a recent range expansion, or large amounts of gene flow. One unexpected finding was the detection of Cyt-b haplotypes characteristic of *E. guttolineata* in southern populations of *E. longicauda*. This finding suggests that further examination of the contact zone between these lineages will be necessary to resolve the specific status of these salamanders.

220 - An Examination of the Contact Zone between Northern and Southern Two-Lined Salamanders (*Eurycea*)

Mei Liu, Trina Phan, David Beamer

Nash Community College, Rocky Mount, NC

The two-lined salamanders (Eurycea: Plethodontidae) are common, wide-ranging, lungless, salamanders, distributed from southeastern Canada to the Gulf Coast and westward to Louisiana, Arkansas, and Illinois. The Northern two-lined salamander (Eurycea bislineata) range extends from eastern Canada to mid-Virginia. The Southern two-lined salamander (Eurycea cirrigera) occurs from mid-Virginia to the southern United States. As Plethodontid salamanders, we hypothesize that populations distributed across this vast area would show considerable genetic differentiation. To better understand the distribution of these different species, we have sampled 75 populations from throughout the range. In order to ascertain the phylogenetic position of these populations, we have amplified, purified, and sequenced 1500 base pairs of the mitochondrial gene ND2 in these populations. We created a phylogenetic reconstruction using Bayesian inference, with separate partitions for each codon position. Our results confirm a major phylogenetic break between Northern and Southern populations of two-line salamanders; however, our results suggest that the contact zone occurs much further to the south.

221 - Effect of Host Life Cycle on the Richness of the Cutaneous Microbiome of a Salamander

Courtney Bell, Jessica Wells, Richard M. Austin, Jr.

Piedmont College, Demorest, GA

The microbiome of amphibian skins has received considerable research attention within the last two decades. The makeup of the microfloral community may be influenced by habitat, age, and reproductive stage of host amphibians. We sampled and characterized the cutaneous bacterial flora of the Black-bellied salamander, *Desmognathus quadramaculatus*, across salamander life-cycle stages. A total of 12 larvae, 18 juveniles, 6 adult females, and 5 adult males were collected from the West Fork of Wolf Creek, Union County, Georgia. Bacteria were sampled, cultured, and characterized by phenotypic type. ANOVA analysis of type richness for cutaneous bacteria indicated significant differences exist among the bacterial communities that comprise the different life-cycle stages. Post-hoc analyses revealed differences between adult males and both larvae and juveniles. No other pairwise comparisons was significant. Future investigation should focus on the possibility of interaction of adult-male hormones and the bacterial community that might have produced these results.

222 - Host Life History and Antibiosis in a Salamander Cutaneous Microbiome

Morgan Ivey, Richard M. Austin, Jr.

Piedmont College, Demorest, GA

Antibiosis is an important factor mediating interactions within bacterial communities. Recent discovery of antibiotic producers residing on the skins of amphibians has launched a fruitful avenue of research. The effect of life-cycle stage on the production of antibiotics by resident microflora has not received a great deal of attention. Therefore, we sampled and characterized the cutaneous bacterial flora of the Black-bellied salamander, Desmognathus quadramaculatus, across salamander life-cycle stages. Bacteria were sampled and phenotypically characterized. They were then tested for their ability to produce antibiotics effective in inhibiting bacterial growth in known Gram-positive and Gram-negative bacteria. A total of 113 phenotypically distinct bacteria were isolated across larvae, juvenile, adult female, and adult male salamanders. Cutaneous bacteria isolated from each life-cycle stage were found to possess the ability to produce antibiotics capable of inhibiting the growth of Escherichia coli and/or Enterococcus faecalis. Variation occurred in the size of inhibition zones produced by different bacteria. However, ANOVA analysis indicated no significant difference in the number of antibiotic producers across life-cycle stages.

223 - Progesterone Receptor Dynamics in RAW 264.7 Cells: Effects of Immunomodulation on Receptor Expression

Darien Woodley, Christopher Brandon

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It has been widely established that, in addition to its role in reproduction, progesterone (P4) has potent anti-inflammatory properties. While the precise mechanisms have never been clearly elucidated in RAW 246.7 cells, it seems logical to assume that this response is – at least in part - a consequence of activation of the progesterone receptor (P4-R). In addition to the commonly known intracellular P4-R, it has recently been reported that membrane bound P4-R isoforms also exist (mP4-R) which are G protein-coupled receptors, and cell stimulation occurs via the activation of complex intracellular signal transduction pathways. In these experiments we investigated mP4-R expression dynamics in RAW cells in the presence and absence of two potent inflammatory mediators – lipopolysaccharide (LPS) and peptidoglycan (PGN). Initially, RAW cells were incubated in serial dilutions of FITC-P4 (10 – 100 nm) to determine receptor expression as well as receptor density. To ascertain the effect of an inflammatory insult, RAW cells were incubated in either LPS (2, 20, 200 ng/ml) or PGN (10, 50, 100 µM) - all analyses were performed via flow cytometry. Our results indicate that 1) RAW cells express the P4-R on the plasma membrane and bind P4 with high affinity and saturability and 2) that incubation in both LPS and PGN results in an upregulation of receptor expression in a concentration-dependent manner as compared to controls. These results are promising for further investigations into the unique anti-inflammatory properties of P4 in RAW 264.7 cells.

224 - Investigation of the Cytotoxicity of Soursop Fruit Extract on Hep-G2 Cells

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Before the field of medicine was established, humans used plants as a means of healing. The Annona muricata broad leaf tree has been used in the Caribbean for centuries to treat a variety of health disparities including parasitic infections, arthritic pain, and cancer (Moghadamtousi et al. 2015). Although different parts of the tree are used for healing, the fruit, commonly known as “soursop”, is more often consumed for nourishment. The soursop fruit contains a variety of

phytochemicals whose effects are still not understood (Moghadamtousi et al. 2015). Recent cancer research has found evidence that leaf extracts of A. muricata have cytostatic and cytotoxic effects on carcinogenic hepatic, lung and breast cells (Moghadamtousi et al. 2014, Hualiyang et al. 2016). However, the anticancerous properties of the soursop fruit have yet to be explored. The current study aims to investigate the dose-dependent cytotoxicity of a soursop fruit pulp extract on the Hep-G2 carcinogenic liver cell line. Works Cited Hualiyang, NL and S Lee. 2016. Ethanol Extract of Annona muricata. L Induces Liver Cancer Cell Apoptosis through ROS pathway. Biomedical & Pharmacology Journal 9.3: 919-925. Moghadamtousi SZ, M Fadaeinasab, S Nikzad, G Mohan, HM Ali, HA Kadir. 2015. Annona muricata (Annonaceae): A Review of Its Traditional Uses, Isolated Acetogenins and Biological Activities. Int. J. Mol. Sci. 16(7): 15625-15658. Moghadamtousi, SZ, HA Kadir, MJ Paydar, E Rouhollahi, H Karimian. 2014. Annona muricata leaves induced apoptosis in A549 cells through mitochondrial-mediated pathway and involvement of NF-κB. BMC Complementary and Alternative Medicine 14.299: 1-13.

225 - Seeding and Recellularization of Porcine Acellular Muscle Matrix Biomaterials with Adipose-Derived Mesenchymal Stem Cells and C2C12 Myoblasts

Anneke van Eldik, Natalie Mseis, Schroen Jennifer, Chandler Burt, Collins Tierra, Matthew Stern

Winthrop University, Rock Hill, SC

The ability of skeletal muscle to repair itself via regenerative mechanisms is limited to instances where tissue damage is relatively small. When volumetric muscle loss occurs, the regenerative capacity of skeletal muscle is exceeded. This results in a permanent loss of muscle volume and function. Current strategies to replace or repair such damage are inadequate. The goal of this project is to develop natural biomaterials that facilitate the engineering and/or regeneration of skeletal muscle tissue by providing a myoinductive environment for seeded and/or infiltrating cells. We hypothesized that scaffolds and hydrogels composed of porcine acellular muscle matrix (PAMM) could be efficiently recellularized and support myogenic differentiation. Here, we describe the production and characterization of PAMM scaffolds and gels. Histological analyses, DNA content measurement, and scanning electron microscopy show that porcine skeletal muscle tissue can be effectively decellularized and processed into both a sheet-like scaffold and a hydrogel. We also demonstrate that PAMM biomaterials can be recellularized with murine adipose-derived mesenchymal stem cells and the C2C12 myoblast cell line. These results demonstrate the potential for PAMM biomaterials to be employed in tissue engineering and regenerative medicine based strategies for repairing volumetric muscle loss.

226 - How bad could it be? Characterizing the effects of Hookah smoke sources on lung cells

Hannah Stadtler, John Cook, Noa Schork, Shi Chen, Chisom Odemena, Karen Bernd

Davidson College, Davidson, NC

Waterpipe smoking has significantly increased worldwide, with college-aged people making up a large proportion of new users. Most waterpipe smokers utilize a substrate called shisha, consisting of tobacco, humectant, and a variety of flavorants. The health effects of this commonly used substrate have not yet been defined. This research investigates the effect of different shisha subcomponents on cell viability. We developed and optimized an exposure apparatus modeling smoke impacting lung cells. Unlike others, our research incorporates cellular exposure at the air-liquid interface at airflows more similar to those in the alveolae and allowing chemical and physical effects of smoke on the epithelial cells to be determined. Transwell filters seeded with rat alveolar cells were exposed to ambient air (AA), or smoke generated by charcoal heating shisha (C+S), glycerol on Teflon (CGT), dry Teflon (CT), or

shisha syrup (SS) following the standard Beirut smoking protocol and using a medium height waterpipe and 72" silicon hose. After a 24hr recovery period, effects of the different treatments were determined and compared to those from the AA treatment. The impact of charcoal heat will be presented as well as data showing C+S smoke resulted in a decrease in membrane permeability while C+S and CSS smoke negatively impacted lysosomal function. These data indicate whole shisha smoke meets the NIH definition of cytotoxicity.

227 - The Effects of Uniaxial Stretch on Adipose-Derived Stem Cells Cultured on Flexible Silicone Membranes with Different Material Properties

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Cellular physiology is regulated by both biochemical and mechanical stimuli received from the environment. Traditional cell culture experiments typically focus on manipulation of the biochemical stimuli present in cell culture medium while largely ignoring the role of mechanotransduction in the cellular processes being studied. A growing body of literature demonstrates that systematic manipulation of the physical/mechanical environment of cultured cells can be effectively used to drive a desired outcome–such as stem cell differentiation into a particular lineage. We are interested in the use of adipose-derived mesenchymal stem cells (ADSCs) as a plentiful and easily-obtained source of patient-matched multipotent stem cells for tissue engineering applications, including skeletal muscle tissue engineering. While ADSCs are capable of robust *in vitro* differentiation into several lineages, their ability to undergo (skeletal) myogenic differentiation is relatively limited. We hypothesized that the culture of ADSCs on flexible silicone membranes combined with the application of uniaxial stretch would increase the ability of ADSCs to differentiate down the myogenic lineage. Here, we describe the development and testing of a culture system that allows us to tune the material properties of the silicone membranes used as substrates for cell culture and apply precise regimens of uniaxial stretch to cells cultured the membranes. Our results show that both culture on silicone membranes and exposure to uniaxial stretch alter the properties of ADSCs under standard growth conditions. Future work will seek to identify a combination of biochemical and mechanical stimuli that improves the efficiency of myogenic differentiation of ADSCs cultured within this system.

228 - The effect of rosehip extract on LNCaP prostate cancer cells

Emily Hahn, Kevin Suh

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Rosehip, also known as dog rose and rose haw, is the fruit of *Rosa canina* and has traditionally been used to treat disorders such as arthritis. Recent studies have proved that rosehip extract can decrease glioblastoma cell proliferation. In this lab, we tested the effect of rosehip extract on LNCaP prostate cancer cells. LNCaP cells were treated with varied concentrations of rosehip extracts (0, 50 ng/ml, 25 ug/ml, 250 ug/ml, 1 mg/ml, and 1.5 mg/ml) for 24, 48, and 72 hrs. We performed MTT assay to measure the viability of the cells. Metabolically active cells reduce MTT ((3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) to colored formazan products. This can be dissolved by the addition of dimethyl sulfoxide and quantified by measuring the absorbance at 570nm. We observed that rosehip extract decreases the viability of LNCaP cells in a dose-dependent manner. In LNCaP cells the PI3K (phosphoinositol 3-kinase)/Akt signaling pathway is constitutively active which confers growth advantage to the cells. This is due to a mutation in PTEN (phosphatase and tension homologue), a negative regulator of PI3K. Western blot analysis will be utilized to see the signaling pathways targeted by rosehip extract including PI3K/Akt pathway.

230 - Arabinogalactan protein expression during spermatogenesis in the model moss *Physcomitrella patens*.

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From the charophycean algae that release biflagellate sperm cells in their aquatic homes to the highly specific interactions between plants and pollinators in Angiosperms, the male gamete production has shown dramatic change throughout the evolution of plants. The biggest changes ultimately result from plants becoming better adapted to drier land, whereas the advent of pollen encapsulates the sperm cell to deliver to the egg, followed by an eventual loss of flagella. One class of excreted glycoproteins, arabinogalactan proteins, has been reported in sperm and pollen production in all plant phyla, except bryophytes. While these proteins play roles in many processes throughout the plant kingdom, their mode of action is largely unknown. They have recently been shown to be critical to sperm development in ferns but are notably absent from charophytes. The model moss, *Physcomitrella patens*, provides a facile system to study developmental changes in moss because sperm cell development is easily cued. Preliminary data suggests that the population of AGPs changes at the onset of spermatogenesis. The aim of this study was to map changes in AGP expression in the model moss *Physcomitrella patens* using RNAseq across three time points during spermatogenesis. Surprisingly, of the 105 AGP-encoding genes analyzed, only 1 was identified as upregulated; suggesting that a single gene may be responsible for the production of sperm-cell specific AGPs. Interestingly, several BURP-domain containing proteins, a group frequently secreted and found to play roles in spermatogenesis and fertilization in most lineages, where some of the most up-regulated genes identified. Taken together, this suggests that AGPs' importance in spermatogenesis may be limited, but other secreted proteins may play important roles. Future studies are assessing individual functions of the identified genes.

231 - Complete Genome Sequence of a Pseudomonad Bacteriophage from Calhoun County, AL.

Ashraf Amshagn, Chris Murdock, William Tyler Daprano, Benjie G. Blair

Jacksonville State University, Jacksonville, AL

It has become widely accepted that bacteriophages are extremely abundant and apply enormous influences on the biosphere. Furthermore, bacteriophages kill between 4-50% of the entire bacteria population daily (Suttle, 2005). The aim of the study was to screen soil and water samples for *Pseudomonas aeruginosa* lytic phages and characterize a select isolate morphologically and by analyzing the genome using next generation sequencing (Illumina) methods. Samples of water and soil were collected and used with an enrichment protocol for isolation of a *Pseudomonas* phage against a *P. aeruginosa* ATCC 27853 as the selective host. The lytic isolated phage was isolated by spot method on lawns of *P. aeruginosa*. Using the described procedure (Howard Hughes Medical Institute, 2011), phages were successfully isolated only from soil samples, while in water samples no *P. aeruginosa* phages were detected. Transmission electron microscopy (TEM) performed by the UAB High Resolution Imaging Facility (HRIF) and Illumina Next generation sequencing (NGS) also at UAB, were preformed to identify the phage. The TEM images reveal that the phage has a short tail when compared to other *Myoviridae* phages. Upon performing the Blast NCBI sequence comparison analysis it was determined that this isolate is 99% identical to the *Pseudomonas* phage phi176 with 163 blast hits to other phages. Further gene comparisons are being performed to develop a phylogenetic relationship profile to determine if there is a common genetic origin for these phages.

232 - Role of Integrin alpha 6 (ITGA6) in Neurovascular Development and Stroke

Ben Siclare

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Cerebrovascular diseases are one of the leading causes of death worldwide, and it is estimated a stroke occurs every 40 seconds in the United States. A Korean study found a statistically significant correlation between single nucleotide polymorphisms of the integrin alpha 6 (ITGA6) gene and the occurrence of stroke within the population. These findings indicate ITGA6 is required for normal neurovascular development, but it's role in angiogenesis lacks sufficient research. ITGA6 deficient zebrafish embryos displayed improper vascular development relating to vascular structure, number of protrusions, and levels of hemorrhaging. In this study, the overexpression of full length, truncated, and mutated versions of human or zebrafish ITGA6 will be analyzed via immunohistochemistry staining, confocal microscopy, time lapse imaging, and hemorrhage assays. Transgenic embryos will display green fluorescence (*Tg (fli1a:gfp)*) in the vascular tissue and red fluorescence in the blood cells (*Tg (Gata1:DsRed)*). At the one cell stage, the embryos will be injected with human or zebrafish RNA that will express the full length, truncated, or mutated versions of this protein. The embryos will develop for 48 hours under normal conditions before being fixed with 4% Paraformaldehyde to stain for blood vessels and red blood cells with the green and red fluorescent protein antibodies, respectively. This study aims to humanize the zebrafish by forcing the expression of a human protein. The embryos treated with the non-wild type integrin would be expected to display elevated levels of angiogenesis pertaining to central artery development and number of protrusions. From here, drug screening this organism could produce results that are applicable to a human system since zebrafish are a model organism for humans. With these expected results, genes or protein products could hopefully be used in therapeutic and diagnostic strategies.

233 - The Effects of Nicotine as a Neuroprotectant Against Nigrostriatal Damage

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Parkinson's Disease (PD) is a neurodegenerative disease in which there is a progressive loss of dopaminergic neurons in the substantia nigra pars compacta. There is a demand for neuroprotective agents and strategies that could prevent the disease from progressing, at the least. Experimental studies have accumulated evidence that nicotine can protect against neural damage by influencing the production of the cytokine. The increase of cytokine is attributed to the activation of microglia in response to neurotoxic insult. This study aims to determine the effect of nicotine on inflammatory cytokines, such as IL-6, to further investigate nicotine's anti-inflammatory qualities. In this study, E18 rat substantia nigra neurons were cultivated and treated with 200 nM of nicotine or it's vehicle. After five days, 200 nM of MPTP (1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine), a common neurotoxin used to model PD, was administered in the presence and absence of nicotine. Immunocytochemistry data revealed that the cells treated with MPTP had an increase in GFAP whereas neurons that were administered the dosage of nicotine had a reduction in the quantity of GFAP. These findings suggest that nicotine reduced the likelihood of glial activation, a marker for neurotoxicity. An ELISA assay was also conducted to determine the effect of nicotine in IL-6 inflammatory cytokine. These findings will provide potential mechanisms for nicotine's neuroprotectant effects.

234 - Oxidative Stress Promotes Activation of the p75 Neurotrophin Receptor in Dopaminergic Neurons.

Cassandra Escobedo, Alborz Kalantar, Briana Ford, Carter Waugh, Bradley Kraemer

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The p75 neurotrophin receptor ($p75^{NTR}$) mediates the death of specific neuronal populations during development and in response to various types of injury. Tissue damage can promote increased production of neurotrophins, ligands that bind and activate $p75^{NTR}$. Upon activation, the receptor is cleaved by TNF-α converting enzyme (TACE) and the γ-secretase complex, thus releasing the intracellular fragment of $p75^{NTR}$ to interact with downstream mediators of apoptosis. From analyses of sympathetic neurons, we previously discovered a novel, ligand-independent mechanism of $p75^{NTR}$ activation in which proteolysis of the receptor is induced by oxidative stress, a cellular condition associated with numerous pathological conditions. However, whether such a mechanism of receptor activation underlies the ability of $p75^{NTR}$ to promote degeneration in damaged regions of the brain has not been investigated. In the present study, we set out to determine whether oxidative stress induces $p75^{NTR}$-mediated death of dopaminergic neurons in the ventral midbrain, a region that selectively degenerates in individuals affected by Parkinson's disease. To overcome limitations of primary cultured dopaminergic neurons for protein analysis, these investigations were conducted using Lund Human Mesencephalic (LUHMES) cells, a population of conditionally immortalized human midbrain cells that can be differentiated into post-mitotic, dopaminergic neurons. Abundant expression of $p75^{NTR}$ was detected in the LUHMES-derived neurons, and treatment of the cells with 6-hydroxydopamine (6-OHDA), an oxidative stress-inducing compound commonly used to model Parkinson's disease, resulted in cleavage of $p75^{NTR}$. Our preliminary data indicates that the neurons express low levels of pro-nerve growth factor (pro-NGF), a neurotrophin with high-affinity for $p75^{NTR}$, though pro-NGF production was unaltered by 6-OHDA treatment. Currently we are further exploring the role of neurotrophins in oxidative stress-induced $p75^{NTR}$ activation in dopaminergic neurons. This work will enhance our understanding of mechanisms through which $p75^{NTR}$ is activated and elucidate the contributions of the receptor to neurodegeneration associated with Parkinson's disease.

235 - Investigation of the genes of *Saccharomyces cerevisiae* required for viability in environments lacking sulfur or nitrogen

Perry Kezh, Liz Dreggors, Amy Wiles

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The yeast *Saccharomyces cerevisiae* is a model eukaryotic organism whose genome has been sequenced and widely studied. To discover the genes in *S. cerevisiae* required for viability in environments lacking sulfur or nitrogen, a growth assay was performed on a knockout library containing 5,132 strains of *S. cerevisiae*, each with a specific and different gene removed. The growth assay was performed with a control medium containing sulfur and nitrogen, an experimental medium containing limited sulfur, and an experimental medium containing limited nitrogen. The optical density of each culture grown in each of the three media was determined. Genes knocked out from strains that displayed low growth in sulfur and/or nitrogen deficient conditions were flagged as candidate genes, necessary for either sulfur metabolism, nitrogen metabolism, or both. Growth data was normalized using two methods to account for variation between plates: background subtraction with subsequent quantile normalization and cellHTS2. Candidate genes were found to be in the top five percent of normalization results for each experimental medium and were validated to confirm their necessity in sulfur or nitrogen limited conditions. Validated genes of interest are being investigated to discover their Gene Ontology classifications, roles in metabolic pathways, and

relevant protein-protein interactions. This research will help identify genes required for sulfur and nitrogen metabolism and genes required for nutrient stress response.

236 - The Effect of Water Quality of the Immune Response of Catfish

Shoshana Katzman, Stephany Sifuentes, Rosemary Melendez, Rebekah Ward, Peter Sakaris, Elisabeth Javazon

Georgia Gwinnett College, Lawrenceville, GA

We aim to assess the impact of water quality, possibly due to pollution from anthropogenic activities, on the immune responses of local fish population's from three tributaries of the Chattahoochee River and local creeks of Northern Georgia. These creeks have been designated as least impacted, moderately impacted or severely impacted, based on land-use in the watershed and ecological impairments reported by Georgia Environmental Protection Department. The levels of pollution, and the resulting microbiome changes may also directly affect the immune response, which can be investigated by examining changes in the immune response of fish and correlating to the level of pollution. We have isolated splenic lymphocytes from snail bullhead catfish from multiple creeks in Northern Georgia to examine the effect of pollution on the gene expression levels of pro-inflammatory cytokines including IL8, IL1β, TNF-α, and CXCL10. In addition, we will analyze the splenic lymphocyte populations via flow cytometry to determine if levels of pollution alter the resident lymphocyte populations.

237 - Effects of Polarization Status on Degradative Ability of THP-1 Derived Macrophages

Dalton Sizemore, Megan Polzin, Maryam Ahmed, Darren Seals

Appalachian State University, Boone, NC

Podosomes form along the ventral surface of professionally invasive cell types and promote both adhesion to and degradation of the extracellular matrix. Such is the case of macrophages, which play a surveillance role in organ tissues against infection or injury. Macrophages, however, have distinctive polarization profiles. M1 macrophages promote inflammation, stimulate host immunity, and produce cytotoxic reactive nitrogen and oxygen species in response to host infection. M2 macrophages, in contrast, decrease inflammation, curtail host immunity, and focus on wound healing in response to tissue injury. We have wondered whether the nature of podosomes and the invasive behavior they confer is different between these two macrophage polarization extremes. To that end, model THP-1 monocytic leukemia cells were differentiated into adherent macrophages following exposure to lipopolysaccharide and interferon gamma (M1) or interleukin-4 and interleukin-13 (M2). Polarization was verified by the unique morphologies in the two cell types and the expression of common polarization markers like phosphorylated STAT1 (M1), CD204 (M2), and the podosome scaffolding protein Tks5 (M2). Podosomes were identified by punctate organization of filamentous actin while gelatin matrix degrading podosome activity was based on an *in situ* zymography assay. Our data show that despite only seeing robust expression of the Tks5 podosome marker in M2 macrophages, all macrophage subtypes have the ability to form podosomes (podosome incidence). Nevertheless, there is a statistically significant reduction in the number of podosomes in M1 macrophages (podosome multiplicity). Additional studies are in progress to address whether these reductions in podosome number reflect any real difference in gelatin degradation activity or the ability to invade through extracellular matrices.

238 - Post-Translational Modifications of Histone H3 in Mitochondria of Human Jurkat Cells and Related Stress Relief Studies

Mary Katherine Zanin, G. Dillon Graham, John W. DeStefano, Claudia L. Rocha, David M. Donnell

The Citadel Military College, Charleston, SC

Continuing to explore mitochondrial Histone H3, we have performed immunocytochemistry followed by confocal microscopy that verifies co-localization of Histone H3 and COX I in mitochondria of human Jurkat cells, supporting our former reports. Additionally we have evidence from mass spectroscopy analysis of cauliflower samples that Histone H3 in mitochondria may have unique combinations of post-translational modifications as compared with Histone H3 in nuclei. These post-translational modifications may be key to understanding how and why H3 moves from the nucleus to the mitochondria. Oxidative stress could be the trigger for the move; therefore we are trying to relieve oxidative stress of Jurkat cells in culture with a treatment with Vitamin E derivative, Tocopherol Succinate, for comparison of mitochondrial H3 levels between treated and untreated cells.

239 - Macrophage Susceptibility and Behavior When Exposed to Oncolytic Vesicular Stomatitis Virus

Emily Lucero, Megan Polzin, Maryam Ahmed, Darren Seals

Appalachian State University, Boone, NC

Cancer cells do not act autonomously. Their interactions with other 'normal' cell types create a tumor microenvironment conducive for the development, growth, and progression of the disease. An example is the macrophage, an immune cell that phagocytizes pathogens during infection and removes unwanted cellular debris during injury, but which also accumulates in cancerous tissue as so-called tumor-associated macrophages (TAMs). M1-type TAMs are pro-inflammatory, immunostimulatory, and may directly target and kill cancer cells. M2-type TAMs, in contrast, generate the growth factors that support cellular growth, angiogenesis, and metastasis, which thus deem them a desirable target for therapeutics. Vesicular stomatitis virus (VSV) is known for its natural ability to target cancer cells, but its effect on TAMs is unclear. Here we used common agonists to pre-polarize model THP-1 monocytes into M0 (PMA), M1 (PMA, LPS, IFNγ), or M2 (PMA, IL-4, IL-13) macrophages to measure their response to infection with recombinant wild-type strain of VSV (rwt virus) as well as an isogenic mutant strain (rM51R-M virus) that is restricted for growth in normal tissues. The viability of macrophages following infection with VSV was determined by MTT assay. Results indicate that M1 and M2 macrophages are differentially susceptible to killing by rwt and rM51R-M viruses, with anti-tumor M1 macrophages being resistant to the cytotoxic properties of both viruses while the tumor-promoting M2 macrophages being more sensitive. In addition, rwt virus was more effective at killing M2 macrophages than rM51R-M virus (31% viability versus 53% at MOI of 10 pfu/cell). We are currently investigating whether the macrophages that survive viral infection are compromised in their invasive ability through microscopic examination of cytoskeletal structures called podosomes and expression of known podosome marker proteins. The greater susceptibility of M2 macrophages to distinct oncolytic VSV strains suggests newfound benefits for anti-cancer virotherapies that target TAM populations.

240 - Comparison of histopathological evaluation to assess the effects of pollution in two creeks of Columbus, GA using livers of Largemouth bass (*Micropterus salmoides*).

Amy Sibley[1], Elizabeth Klar[1], Jeramy Belt[1,2], Michael Newbrey[1]

[1]Columbus State University, Columbus, GA, [2]Columbus Water Works, Columbus, GA

Non-point source pollution in freshwater streams is difficult to quantify without expensive monitoring equipment that must be left in the field. Species that live in these environments can be good indicators of the long-term conditions and levels of contamination in streams. This is primarily because the liver filters wastes from the body and acts as a repository. Accumulation of these wastes can damage liver cells, and that damage is an indicator for possible presence of waste in streams. We compared liver cell damage between Largemouth bass (*Micropterus salmoides*) collected from two streams in Muscogee County, Georgia for evidence of non-point source pollution. Heiferhorn Creek (n= 19 bass) is a pristine stream with a functional riparian zone in northern Muscogee County. Conversely, Lindsey Creek (n= 17 bass) runs through the center of Columbus, GA and has a highly altered riparian area. Largemouth bass were collected from these areas using backpack electrofishing and seine net methods. Largemouth bass ranged in length from 5.5 cm to 34.5 cm and 1 year to 5 years in age. Livers were weighed and preserved in 10% neutral buffered formalin. Tissues were stained with hematoxylin and eosin. Two histological evaluations were compared. First, the area of hepatocyte hypertrophy and total area of liver section was measured using ImageJ software. Second, the same sections will be examined to quantify hepatocyte counts and sizes. Healthy livers are expected to have lower areas of hypertrophy, and higher numbers of hepatocytes, and smaller cell sizes. Largemouth bass livers from Lindsey Creek are expected to exhibit more incidence of cellular degeneration than livers from Heiferhorn Creek. By determining superior forms of evaluation of histological samples, fish tissues can be used to demonstrate potential issues of contaminants in an ecological setting.

241 - Highly conserved histone-mitochodrial interactions across eukaryotes

Vanessa Chappell

Jacksonville State University, Jacksonville, AL

We hypothesize that histone-mitochondrial interaction is a mechanism that communicates DNA or nuclear damage to cell death processes via the mitochondria and is conserved in eukaryotes. It has been determined that in rat liver cell, the 4 core histones and H1 bound to mitochondria and caused release of cytochrome C and other apoptosis-inducing proteins (Cascone et al. 2012). Preliminary work indicates that exogenous H3 binds to mitochondria and a histone-enriched fraction caused cytochrome C release (Major, MSThesis, JSU). We are further investigating histone-mitochondrial binding and cytochrome C release in cauliflower by examining all four core histones. Cauliflower curds are grated with a kitchen grater, blended for 20 1-sec burst in a kitchen blender, the resulting paste is incubated in 12.5% Viscozyme at 37˚C and 150 rpm in a mannitol-containing buffer until the cells are separated and are round in appearance. The resulting protoplasts are fractured by short bursts of sonication. Mitochondria are purified by differential and Percoll density gradient centrifugation. Histone fractions are obtained from crude centirfuged nuclei by step hydroxyapatite chromatography or acid extraction. Mitochondria will be incubated with crude histones, and binding of all four histones as well as cytochrome C release will be analyzed by Western blotting.

242 - Investigating histone binding and histone-induced cytochrome c release from mitochondria in yeast.

Levi Brewer, Vanessa Chappell, Roger Sauterer, Samia Meera, Dianna Thompson, Shelby Harris

Jacksonville State University, Jacksonville, AL

Cytochrome *c* release from mitochondria into the cytoplasm induces apoptosis in mammals and is correlated with cell death mechanisms in eukaryotes in general. Cascone, et al (2012, PLOS One 7:E35357), demonstrated that all four core histones as well as the linker histone H1 bound to mitochondria and induced cytochrome *c* release in rat liver cells. A preliminary study

by Major (M.S. Thesis, JSU 2014) also showed that histone H3-enriched cellular fractions also bound to mitochondria and elicited cytochrome *c* release in cauliflower. We hypothesize that cytochrome *c* release in response to histone binding to the mitochondrial membrane is conserved across eukaryotes and communicates nuclear or DNA damage to the cytoplasm and cell death mechanisms. We are investigating histone-mitochondrial interactions in the unicellular fungus *Saccharomyces cerevisiae* (baker's yeast). Yeast are grown in optimal conditions to an OD of 0.5 or less and used to generate spheroplasts by enzymatic digestion of their cell walls using Lyticase (Sigma). The resulting spheroplasts are gently sonicated for cell fractionation. Mitochondria will be isolated by differential and Percoll density-gradient purification. Nuclei will be isolated by differential centrifugation, and crude histones will be isolated by hydroxyapatite step chromatography or acid extraction. Isolated purified mitochondria samples will be incubated with crude histone samples and assayed for membrane binding and cytochrome *c* release by Western blotting using anti-cytochrome *c* and antibodies against each of the core histones.

243 - Investigating histone binding to mitochondria and histone-induced cytochrome c release in cauliflower.

Vanessa Chappell, Samia Meera, Shelby Harris, Dianna Thompson, Levi Brewer, Roger Sauterer

Jacksonville State University, Jacksonville, AL

We hypothesize that histone-mitochondrial interaction is a mechanism that communicates DNA or nuclear damage to cell death processes via the mitochondria and is conserved in eukaryotes. It has been determined that in rat liver cells, the 4 core histones and H1 bound to mitochondria and caused release of cytochrome C and other apoptosis-inducing proteins (Cascone et al. 2012 PLOS One 7:E35357). Preliminary work indicates that exogenous H3 binds to mitochondria and a histone-enriched fraction caused cytochrome C release (Major, 2014, M.S.Thesis, JSU). We are further investigating histone-mitochondrial binding and cytochrome C release in cauliflower by examining all four core histones. Cauliflower curds are grated with a kitchen grater, blended for 20 1-sec burst in a kitchen blender, the resulting paste is incubated in 12.5% Viscozyme in a mannitol-containing buffer at 37˚C and 150 rpm until the cells are separated and are round in appearance. The resulting protoplasts are fractured by short bursts of sonication. Mitochondria are purified by differential and Percoll density gradient centrifugation. Histone fractions are obtained from crude centrifuged nuclei by step hydroxyapatite chromatography or acid extraction. Mitochondria will be incubated with crude histones, and binding of all four histones as well as cytochrome C release will be analyzed by Western blotting.

244 - A Rapid, High-Yield Method of Obtaining Cauliflower Protoplasts for Cell Fractionation

Shelby Harris, Samia Meera, Dianna Thompson, Vanessa Chappell, Levi Brewer, Roger Sauterer

Jacksonville State University, Jacksonville, AL

Obtaining plant cells for cell fractionation requires either laborious blending or enzymatic cell wall removal, resulting in low yields. We developed a method for obtaining gram quantities of cauliflower protoplasts in four hours using 30-40 g of material. Cauliflower florets were cut and grated using a kitchen grater, then put into a mini-Ninja kitchen blender in 100 to 150 ml of mannitol-containing grinding buffer. The sample was blended with 10 one-second bursts, cooled on ice for 30 seconds, and then blended an additional 10 one-second bursts. The mixture was then filtered through cheese cloth and squeezed to remove excess liquid. 10 grams of the material, consisting of small sheets and clumps of cells, was then placed into 50 ml Falcon tubes with 12.5% Viscozyme (Sigma) in Viscozyme buffer (40 ml total volume).

Tubes were placed in an incubator at 37°C and at 150 rpm. Samples were removed, broken up in a Teflon homogenizer, observed microscopically, and returned to the incubator every 20 minutes. Protoplasting was generally complete after 60-80 minutes of Viscozyme treatment, after which they were washed 2x in Viscozyme buffer without Viscozyme. 1-2 g wet weight of protoplasts were obtained, which could easily be broken by gentle sonication.

245 - Investigating the Validity of Non-GMO Labeling of Soy-Based Products

Alex Menkes, Jake Bond, Luis Valdas, Henry Montoya, Jennell Talley, Ernest Ricks, Jr.

Georgia Gwinnett College, Lawerenceville, GA

America's reliance on genetically modified crops has steadily increased over the past decade. Soy, Corn, Papayas, and Cotton represent some of the most commonly modified crops. According to the USDA, 93% of soybeans in the United States are genetically modified and most are specifically resistant to Roundup Ready Herbicide due to the CP4-EPSPS gene. This modification increases soy plant yield thus aiding soy farmers and soy based product manufacturers. Due to public unrest, as it relates to genetically modified foods, companies produce GMO free or organic-labeled versions of their products and often charge higher prices for them. Several companies like GNC and True Nutrition market GMO-Free, soy-based protein powders. Data suggest that producing GMO-free, soy-based products may present a serious challenge for companies based on the prevalence of GM Soy in America. However, if companies are charging more for products labelled GMO-free, then the products should be free of GMOs. To determine the validity of the Non-GMO claims, we tested for the presence of the EPSPS gene and protein product using both PCR and ELISA, respectively. Based on our preliminary results, we identified the presence of the EPSPS gene in at least one product (GNC Super-Food Non-GMO protein powder). Using primers specifically verified for GMO detection, we are currently investigating the claims of several other companies that produce soy-based products.

246 - Comparison of manual assessment vs. computational analysis on courtship memory in *Drosophila* Alzheimer's model

Breauna Beebe, Eric Helmenstein, Fang-Ju Lin

Coastal Carolina University, Conway, SC

Human Alzheimer's disease (AD) is the most prevalent and lethal neurodegenerative disease. Dementia and motor dysfunction are accompanied by pathological hallmarks like neurofibrillary tangles or amyloid plaques. Although ten percent of Americans at age 65 or older suffer from this disease, the exact cause of the disease is still unclear. Thus fruit fly Drosophila emerges as one of the ideal disease models for it shares similarity to humans in their genetic makeup. By transferring genes that cause human Alzheimer's disease to fruit flies, scientists are able to link function of genes to behaviors. To assess the integrity of learning and memory in transgenic Alzheimer flies, a well-established courtship suppression assay was used in this study. Briefly, naïve male flies that were rejected by previously mated females would reduce the frequency of their courtship behavior, and retain this memory for either short-term or long term. Video recording of courtship behaviors includes wing extension/vibration, chasing, and copulation, with each behavior scored and analyzed by individuals. Our preliminary data showed that transgenic Alzheimer flies exhibited both learning and memory deficits. However, the scoring process is laborious and subject to variation among experimenters. Here we adopt a computer analysis program, Ctrax, and compare the results with manual scoring. We aim to validate this computational analysis to make this process more efficient and less biased.

247 - Investigating Circadian Control of UV-B signaling in *Arabidopsis thaliana*

Morgan Gaglianese-Woody

Appalachian State University, Boone, NC

Plants are exposed to daily changing conditions, such as UV-B irradiance. It is therefore critical that plants are able to anticipate changing conditions, so they may respond at the appropriate times of day. Plants respond to changing UV-B exposure through differential expression of genes, and the circadian clock regulates the UV-B signaling response. UV RESISTANCE LOCUS 8 (UVR8) is the nuclear photoreceptor that senses UV-B irradiance, and we hypothesized that UVR8 re-dimerization is the target of circadian control. UVR8 exists as a homodimer in the absence of UV-B and monomerizes when it senses UV-B, leading to downstream regulation of genes. REPRESSOR OF UVB PHOTOMORPHOGENESIS genes (*rup1*, *rup2*) regulate UVR8 re-dimerization *in vivo*, allowing the photoreceptor to be recycled. UVR8 protein abundance remains constant throughout the day, yet UV-B signaling response is circadian regulated. Since RUP2 transcription is circadian regulated, repression by RUPs may be the target of circadian control. To determine if RUPs mediate circadian control of UV-B regulated gene expression, the expression levels of circadian regulated and UV-B induced genes, ELIP1 and PRR9, were compared in UV-B and non-UV-B treated *rup1rup2* mutant *Arabidopsis thaliana* seedlings using RT-qPCR. The results indicate that UV-B induction is more severely gated in *rup1rup2* mutants for ELIP1 and PRR9. These results suggest that UVR-8 re-dimerization is not the target of circadian control, and that circadian control of UV-B induced genes occurs downstream of UVR8 monomerization.

248 - Analysis of Organelle Genome Through Barcoding of Sabal Palms

Dailyn Figueredo

Miami Dade College, Miami, FL

DNA Barcoding has been used to determine genetic similarity between species. Plants contain two organelles, each having a different genes that can be targeted for barcoding. For this project, both RuBisCo and Cytochrome C oxidase subunit I were the targets. RuBisCo found in the chlorophyll genome, is a gene necessary for the conversion of CO_2 absorbed by photosynthetic organisms to produce glucose. Cytochrome C oxidase subunit I (COI) sequence, found in the mitochondria, is suitable for the role as it has an often fast enough mutation rate to distinguish closely related species, as well as also being conserved among conspecifics. The goal is to clone and sequence these genes and using barcoding strategies compare it to species within the Sabal genus. During this project, extracts were generated through a series of blending and centrifuging steps and a DNA extraction kit was used to isolate the organelle DNA from *Sabal mexicana*. DNA was later verified to determine if it was degraded or viable for further experiments. Future work will focus on determining the appropriate PCR conditions to target the COI gene in the mitochondrial genome and RuBisCo gene in the chlorophyll.

249 - Establishment of an *in vitro* cell culture system to study neurodegeneration in *Drosophila melanogaster*

Leland Earp, Fang-Ju Lin

Coastal Carolina University, Conway, SC

The formation of plaques in the brain from amyloid-β42 (Aβ42) are believed to give rise to Alzheimer's disease (AD). Aβ peptides are produced from proteolytic processing of the transmembrane Aβ precursor protein (APP). Drosophila melanogaster have been used as the model organism for understanding the neuropathology of AD. Our goal is first to establish a

primary cell culture model from Drosophila brains, which can later provide a platform for pharmacological screening in vitro. Cells were isolated from a transgenic line of Drosophila that carry over-expressed human Aβ42 peptides. Immunofluorescent staining was performed on the brain and primary cell culture identifying the location of Aβ42. Cell viability and morphology are used to validate this in vitro model. An array of assays were performed to determine the toxicity of Aβ42 peptides as well as other effects on adult D. melanogaster. Different chemical compounds were tested to determine their effects on the buildup of Aβ42. Currently there is no commercially available neuronal culture for Drosophila. Our study will provide a novel system to study neurodegeneration.

250 - The Implementation of 3D Printing and 3D Bioprinting in Biomedical Research, Education, and Community Service at a Primarily Undergraduate Institution

Chandler Burt, Anneke van Eldik, Matthew Stern

Winthrop University, Rock Hill, SC

Technologies such as 3D printing and 3D bioprinting are becoming increasingly common in biomedical research. These technologies hold great promise for the production of custom devices, including living bioengineered products, that improve the lives of patients. The production of advanced bioengineered products requires the combined expertise of several fields including engineering and biology. However, introduction to technologies such as 3D printing and 3D bioprinting is not common for undergraduate biology students, particularly those at primarily undergraduate institutions (PUIs). Here, we describe a project in which undergraduate students employed a 3D printer and a 3D bioprinter for research purposes while also demonstrating their potential to be used in undergraduate biology education. A relatively inexpensive Flashforge Creator Pro was used to 3D print objects for research and educational use and will serve as the platform to introduce Winthrop biology students to basic 3D printing technology. A BioBot1 was used in our 3D bioprinting work and will also be used to introduce students in select Winthrop biology courses to bioprinting technology. In addition, we have established the Giving Hands student organization, which will be a Winthrop-based chapter of the e-NABLE community–a global organization whose members volunteer to 3D print and distribute mechanical hands for individuals with upper limb differences. Together, these efforts have established the infrastructure required to introduce Winthrop biology students to 3D printing, 3D bioprinting, the workflow involved in each (design, programming/software, troubleshooting), and the many applications of these technologies within the biological sciences.

251 - Exploring how changes in nutrient availability affect the the zooxanthellae cell division cycle

Lacey Tallent, Geoffrey Mitchell

Wofford College, Spartanburg, SC

A relationship exists between reef-building corals and symbiotic zooxanthellae residing within them. These photosynthetic algae (*Symbiodinium* spp.) harvest energy from sunlight and share it with their coral hosts, gaining a stable supply of nitrogen in return. This relationship, which is critically important for reef health, is exquisitely delicate. Exposure to temperatures even marginally above the average annual maximum can cause corals to expel their residents—a phenomenon known as coral bleaching. Bleaching is often permanent and can have a massive impact on the reef environment. To establish symbiosis in the first place, corals produce a signal that forces *Symbiodinium* into a non-dividing state. An unknown signal (or multiple signals) then coordinates coral-algal divisions to maintain the proper density of symbionts. Evidence suggests that failure of the host to maintain control of algal cell divisions at high temperatures may be a cause of bleaching. Unfortunately, little is known about cell

cycle regulation in *Symbiodinium*, so this host-mediated control of symbiont cell division is poorly understood. We have identified cell cycle genes in the recently published genome of *S. minutum* and are determining which of these genes are regulated by changes in nutrient status (nitrogen, phosphate, etc.). With these data, we hope to address the hypothesis that corals control zooxanthellae numbers by limiting their access to nutrients (particularly nitrogen).

252 - City Birds: Avian Diversity and Abundance in Jacksonville, FL

Joan Spinelli, Natasha Vanderhoff

Jacksonville University, Jacksonville, FL

Urbanization is rapidly changing the landscape in which birds live. Habitat alteration and degradation, increased noise and light levels, as well as changes in food resources can affect the distribution and abundance of birds in urban areas. Generally, urban areas have a high abundance of birds, but relatively low diversity. We examined avian abundance and diversity at four sites in Jacksonville Florida that varied in their amount of urbanization. We conducted point counts over a 12-month period, recording species and the number of individuals, as well as the amount of human foot traffic. For each site we calculated the Shannon-Wiener diversity index. We also examined whether or not there was a correlation between human foot traffic and the diversity of birds. As expected the most urbanized site located in downtown Jacksonville had the lowest diversity as well as the highest foot traffic, but the other sites, including a city park, a college campus and a nature preserve had relatively high diversity.

253 - Measuring spatial and temporal shifts in forest structure and composition post-beech bark disease in Great Smoky Mountains National Park

Lee Rumble, Ashley Morris

Middle Tennessee State University, Murfreesboro, TN

Forest pests and pathogens are among the most serious environmental threats to millions of acres of forested land across the United States, yet, they are present in all forest ecosystems. While pests and pathogens play critical roles in maintaining healthy forest ecosystems, in Great Smoky Mountains National Park (GRSM), they pose serious threats to native flora. Since pests and pathogens often target a single species and remain as a long-term part of the forest ecosystem, they impact individual species over prolonged periods of time, such as is the case in 'beech gaps' of GRSM. Beech gaps are unique, high-elevation (> 1,524 m) deciduous forests where American beech (*Fagus grandifolia* Ehrh.) dominates the landscape, often occurring in pure stands. High-elevation beech gaps occur infrequently throughout the Park (< 4,000 ha) and can be found interspersed among the dominant high-elevation forest type—the spruce-fir matrix. However, local beech gaps are being impacted by Beech Bark Disease (BBD)—a pathogenic complex consisting of both scale insects (*Cryptococcus fagisuga* or *Xylococculus betulae*) and fungal associations (*Neonectria faginata* or *N. ditissima*). BBD was first identified in the Park in 1986 and has since led to extensive aboveground mortality of American beech, contributing to shifts in forest composition and structure. In 1994, ten long-term monitoring plots were established and sampled biennially by Park staff until 2012. This research continues one of the three, longest-running forest health monitoring programs in GRSM and seeks to uncover both spatial and temporal shifts associated with American beech mortality. Our sampling methods follow those established by the Park to quantify shifts over time. Since high-elevation beech gaps are uncommon in GRSM, the loss of *F. grandifolia* (the species which defines beech gaps) will have broad consequences on the associated biota, overall ecosystem function, and long-term stability of high-elevation beech gaps.

254 - Utilization of Persimmon fruit (Diospyros virginiana) by mammals in north Georgia

Lawrence Wilson[1], Christopher Mowry[2], Ellen Dymit[1]

[1]Emory University, Atlanta, GA, [2]Berry College, Mount Berry, GA

The American Persimmon tree (Diospyros virginiana) is a dioecious tree that ranges throughout the southeastern United States. Female persimmon trees reliably bear crops of medium-sized fruit which fall to the ground when ripe, generally starting in late September and lasting well into December. These fruit provide a choice source of food for several mammal species including, gray squirrel (Sciurus carolinensis) , Virginia opossum (Didelphis virginiana), raccoon (Procyon lotor), red fox (Vulpes vulpes), white-tailed deer (Odocoileus virginianus), and coyote (Canis latrans). Our study utilized remote trail cameras to document visitation by mammals to fruiting persimmon trees. The study was conducted at ten sites from September 2017 until January 2018 with over 400 trap days and over 300 images/video clips of mammals excluding gray squirrels. We compared sites with persimmon trees versus sites without persimmon trees. Sites containing persimmon trees experienced higher total visitation (n=224) than those sites without persimmon trees (n=84). Sites with persimmons experienced higher total visitation for the six mammal species studied. The three most frequent visitors were white-tailed deer, gray squirrel and Virginia opossum. Deer were the only species that was not significantly more common at non-persimmon sites than those sites with persimmon. Other mammals observed at persimmon trees were red fox, raccoon, and coyote. Deer probably provide little benefit to seed dispersal of the persimmon. The other species not only disperse persimmon seeds but also provide useful scarification of the seeds perhaps enhancing germination rates. Persimmon seeds were found in raccoon, coyote, red fox and opossum scat with some samples of coyote containing as many as 60 persimmon seeds.

255 - Baseline Vegetation Survey in a South Carolina Piedmont Wetland

James Duduit, Thomas Kozel

Anderson University, Anderson, SC

Wetland B in the Rocky River Nature Park is a seasonally flooded, palustrine, emergent, persistent 1.8 ha wetland adjacent to the Rocky River, Anderson County, SC. An attempt is currently under way, using solar pumping of water from Rocky River, to more uniformly hydrate the wetland thereby encouraging increased waterfowl use. To monitor vegetation changes as the hydrograph varies, a baseline survey, utilizing a modification of the North Carolina Vegetation Survey was designed and implemented. After walking through the wetland, five 1 m^2 plots were established within a larger 75 X 20 m plot. All vegetation was counted and coverage estimated in the small plots. Woody species >2.54 cm were counted in the large plot. Vegetation has been monitored monthly, beginning July 2017, continuing to the present. *Polygonum* spp., Knotweed; sedges and *Peltandra virginica*, Arrow Arum dominate in the small plots. *Acer rubrum*, Red Maple, is the most important woody species in the larger plot. Hydration has varied from barely saturated topsoil during the Summer and Fall to complete inundation of small plot vegetation for two consecutive days following an ~9 cm in 24-hrs rain event. Importance values of woody species in the large plot are presented. A complete list of vegetation observed in the plots and additional species not included in them is presented.

256 - The Effects of Invasive Fire Ants (*Solenopsis invicta*) On Ant Diversity in Coastal North Carolina Longleaf Pine Savannas

Hannah Swartz, Grant Wood, Kaitlin Campbell, Lisa Kelly

University of North Carolina at Pembroke, Pembroke, NC

The invasive fire ant (*Solenopsis invicta*) outcompetes native species, which causes harm to many ecosystems. The purpose of this study was to identify which ant species resided in a longleaf pine savanna ecosystem in North Carolina as well as the impact of this invasive species on native ant communities. During the summer of 2017, workers from invasive fire ant colonies were collected from three sites on the coast. To survey the ant fauna, fire ants and pitfall traps were surveyed along belt transects. The overall analysis will be conducted by comparing the species richness and abundance of the pitfall samples with the number of fire ant colonies present within 12-meter diameters of the pitfall traps. Among the sites surveyed, an additional invasive species of ant was identified, the Chinese needle ant (*Brachyponera chinensis*), in high abundance. These invasive species were more abundant than the native species. Currently, these results indicate that the invasive species may be outcompeting the native species, but further analysis and studies will need to be completed to strengthen these findings. Continued monitoring will also need to be done to detect any changes in the ant community. The sites surveyed in this study are some of the most diverse in terms of fauna and flora in North Carolina, so it is paramount to understand the impact of the invasive ants in order to mitigate any environmental effects of the species.

257 - Biodiversity of Testate Amoeba Communities in Western North Carolina

Madeline Scheer

University of North Carolina at Asheville, Asheville, NC

Testate amoeba (TA) are a diverse polyphyletic group of shelled protozoans that dominate *Sphagnum* peatlands. TA have been used as proxies for water quality, environmental acidity, and land use changes globally, however little work has been done using these microorganisms in the southeastern U.S. Although the modern vegetation of this region is well documented, it's microbial life is not. The primary objectives of this study were to describe patterns of community composition of (TA) in Western North Carolina's remaining wetlands, to develop hypotheses to explain differences within the communities, and to determine if taxa occupy similar ecological niches with respect to substrate moisture, total elemental C and N, and pH. This research will provide valuable data to aid in the analysis of long term studies evaluating environmental and climatic changes in the fen during the Holocene. *Sphagnum* peat moss and soil were sampled from hiking trail and non-trail sites within Panthertown valley of Nantahala forest during the fall of 2016, and Franklin bog in spring of 2017. Non-trail sites represent pristine sites and trail sites represent disturbed sites determined by their respective qualitative level of "trampling". The categories were compared to look for correlations between anthropogenic disturbance and the residential TA population assemblages. The methods include qualitative and quantitative analysis for each sample; moisture class, water table depth, pH, total elemental carbon/nitrogen content, as well as TA identification. TA processing followed standard wash and filtration preparation protocol. Statistical analysis included, Shannon's diversity index to determine the biodiversity of each sample, multivariate ordinations to compare species and environmental variables. Panthertown had high TA biodiversity and statistics indicated that populations were dynamic and changing. Environmental stresses due to drought may have caused variation in species richness.

258 - Pollen in Honey—Key to its Origin and Project for High School Student Research

Martin Farley[1], L.J. McCallum[1], Halona Lewis[1], Anna Oxendine[1], Kaitlin Campbell[1], David Wimert[2], Rita Hagevik[1]

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Bee pollination activities are vital to about one-third of the food consumed by humans. Honey production for human consumption in the United States is an additional resource amounting to

more than 70 million kg annually despite colony collapse disorder in recent years. We have used pollen analysis, a standard approach to evaluating the source and quality, to analyze honey. In addition, we have included high school students in the scientific research reported here as a method of outreach and introduce this population in a rural area to science. Pollen analysis is the key method to determining the location of origin of honey. Relatively few studies have been performed on honeys in the U.S. and there is some controversy about the origin of many honeys commercially available at retail outlets in this country. We have analyzed a suite of honey samples from Research Triangle Park and samples from Robeson and Columbus Counties, NC. Samples were processed by standard techniques: 20 g of honey was diluted by ethanol, centrifuged, and the residue was acetolyzed. Pollen abundance per 10 grams in these samples ranges from 19,800 (very poor to intermediate pollen abundance) to 640,000 (very rich pollen abundance). Initial steps in pollen identification include recognition of basic morphological types (e.g., tricolporate with varying sculpture, tricolpate, and so forth). Key pollen taxa recognized so far include *Trifolium* (clover), and *Quercus* (oak). Identification of additional pollen types in these honeys is continuing research.

259 - Barnacle colonization on *Spartina alterniflora* in Georgia Salt Marshes

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Coastal Georgia salt marshes are dominated by *Spartina alterniflora*, and this species plays a critical role in salt marsh development and maintenance. Therefore, salt marsh conservation efforts are often focused on maintaining *S. alterniflora* populations and promoting plant growth. Recently, barnacles were observed colonizing *S. alterniflora* stems and leaves in Georgia salt marshes, which could potentially have negative impacts on plant productivity. Previous research investigating the impacts of barnacle colonization on *S. alterniflora* in Georgia salt marshes found increased barnacle colonization with increased marine influence, suggesting that barnacle colonization varies spatially. The aim of this study was to continue monitoring barnacle colonization to determine if there are annual variations in spatial and/or temporal patterns of barnacle colonization . During the 2017 growing season, *S. alterniflora* individuals were randomly selected along a 20-m transect and inspected for barnacle colonization in three salt marshes of varying marine influence: (1) marsh adjacent to a boat ramp on the Skidaway River (SRBP; marsh located in the interior portion of a coastal river), (2) fringe marsh along the mouth of the South Channel Savannah River (SCSR; marsh within the river-ocean interface), and (3) marsh bordering the northern end of the beach on Tybee Island (NETI; marsh within the estuarine habitat of a barrier island). Preliminary results showed significantly greater barnacles on plants at SCSR compared to the other two sites. However, the number of barnacles observed on plants in this study was substantially lower compared to colonization observed in 2016. Specifically, there was a 91% decrease in colonization on stems, 95% decrease on live leaves, and 85% decrease on dead leaves. These results suggest that there are annual variations in the intensity of barnacle colonization on *S. alterniflora* that may result in year-to-year variations in impacts on plant productivity.

260 - Determination of Appalachian Plant Communities by Ambient Temperature and Light

Connor Rogers, Matt Estep

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The Tater Hill Plant Preserve was constructed to protect rare and endangered plants in the Southern Appalachians. In order to fully inventory the 1200-acre preserve, a series of 144 variable radius plots were surveyed for tree species and abundance. The data from these observations were analyzed, and each plot was assigned a habitat type based on canopy

cover. Onset HOBO Data Loggers were then deployed in different habitat types, measuring light and temperature. This data will be analyzed to determine if we could observe any differences between habitat types. Analysis will determine whether or not these abiotic factors play a role in delineating forest types, as well as assist in future conservation of the rare plant communities that exist within the Tater Hill Preserve.

261 - Submergent islands in The Barrens: sinkhole pond diversity in the Eastern Highland Rim

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The Eastern Highland Rim ecoregion, the eastern-most portion of the Interior Plateau physiographic province, occurs as a strip that runs southwest to northeast from north Alabama through Tennessee to south-central Kentucky. Sometimes referred to in part as “The Barrens,” this region is a flat to rolling plain that is pressed between the Nashville Basin and the escarpment of the Cumberland Plateau. Prior to European settlement, the majority of this region was oak savanna and prairie maintained by dormant season fire (mean fire interval of 2.9-6.5 years). This landscape is underlain primarily by St. Louis and Warsaw limestones which contribute to frequent sinkhole development and results in a high concentration of natural ponds in this region. With fire suppression and human development, these presumably once open ponds have become confined by oak-maple forest or engulfed by agricultural fields. These ponds are of high conservation value as they serve as refugia for many disjunct species from the Coastal Plain, including numerous taxa rare at the state level. While a few individual ponds have been well-studied (e.g. Goose Pond, a registered national natural landmark), hundreds remain poorly studied or unexplored. Furthermore, while documented specimens from pond sites are numerous from Coffee County, Tennessee, there are substantially fewer collections in all other counties of the ecoregion. An upcoming thesis will address these disparities while comparing and describing the plant communities associated with these ponds. This will be accomplished by quantitatively documenting vascular plant species and vegetation associations as well as identifying biogeographic affinities of these communities.

262 - The development of a restriction fragment length polymorphism system for identifying acorn weevil larvae impacting oak reproduction in north central Alabama.

Andres Leon, Malia Fincher, Johnson David A.

Samford University, Birmingham, AL

Most climate change scenarios predict increased frequency and severity of drought for the southeastern US, which may impact patterns of pulsed acorn production by oaks (Quercus) and seed predation rates by acorn weevils. Studying the impacts of drought on oak-weevil interactions requires a knowledge of the natural history involved, and would be facilitated by a rapid, inexpensive method to identify weevil larvae from multiple oak species. Morphological identification is difficult and molecular methodology, such as DNA sequencing, is costly and time consuming. Here we report on the development of a simplified methodology using restriction fragment length polymorphisms (RFLPs) to quickly identify weevil larvae.

263 - An Exploration of the Ecology, Parasitism, and Control of the Root Parasite *Agalinis fasciculata* (Orobanchaceae) on *Pinus taeda* and *P. elliottii*

Isaiah Amos, Lisa Kolgan, Lytton John Musselman

Old Dominion University, Norfolk, VA

Agalinis fasciculata has a broad range, from Texas to New England, and parasitizes a wide range of vascular plants including some silviculturally important trees. Studies on root parasites, including *A. fasciculata, A. purpurea*, and *Seymeria cassioides* have been undertaken in the past to explore their effects on commercially important species, and to document haustorial anatomy. To date, however, there has been no in depth study of the life cycle and parasitism of *A. fasciculata* specifically. *Agalinis fasciculata* will be grown on seedlings of *Pinus taeda*, and *P. elliottii* to determine how the parasite affects these species. Overall host and parasite size in centimeters, leaf size and color, size and number of parasite flowers, haustoria counts, and dry weights of both hosts and parasites will be used to assess the host-parasite relationship in this study. Germination experiments will determine the importance of light to the seeds of *A. fasciculata*, and viability studies will be done to discover how long these seeds can remain in the soil and retain the ability to germinate.

264 - Soil Characteristics and abundances of seeded prairie species in central North Carolina

Sophia Tesluk, David Vandermast

Elon University, Elon, NC

Piedmont prairies, characterized by their droughty edaphic conditions and slow ecological succession to forest, are endangered ecosystems. While these unique habitats were historically distributed widely throughout the Southeast, they now primarily exist in small, isolated fragments. In order to help preserve and reintroduce Piedmont prairies, this research aims to evaluate the abundances of certain seeded prairie plants and their correlations to soil characteristics in a Piedmont prairie fragment at Loy Farm, part of Elon University. Approximately 0.67 hectares (1.45 acres) of a former agricultural field were seeded with sixteen species of vascular plants native to Piedmont prairies in 2014. In May and again in September 2017, data regarding plant cover were collected from five, 10 x 10 m modules using Carolina Vegetation Survey protocol. Plant presence and cover were recorded for each of eight seeded plant species. Our results indicated a phenological pattern of change in abundances of our study plants across the prairie. Soil analysis indicated that, in the parts of the prairie with greater late-season (September) cover of our study species, soil pH (6.1 vs. 5.6) and Ca (954 vs. 344.5 mg/kg) concentration were significantly higher ($p<.05$), but that total cation exchange and the concentrations of other cations (K, Mg, and Na) were not significantly different. This study shows that, even over a relatively small area, seeded Piedmont prairies can demonstrate the heterogeneity and seasonal variation seen in larger, natural prairies.

265 - First year survivorship of large-scale American Chestnut planting driven by soil moisture

Lillian Culver[1], Tom Saielli[2], Mike Madritch[1]

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Native populations of the American Chestnut (*Castanea dentata*) were decimated by an invasive blight in the early 1900s. The American Chestnut Foundation is making an effort to restore *C. dentata* by developing blight resistant hybrids. However, it is unknown how specific crosses will respond under different planting regimes. In this study, we planted 636 trees from 13 different crosses under two different site treatments: old field and forest understory. Plantings were conducted at W. Kerr Scott Dam and Reservoir in Wilkesboro, North Carolina. During the first growing season we tracked seedling survivorship, soil moisture content, photosynthetically active radiation, and leaf nitrogen content. There were no effects of cross on survivorship. However, seedlings planted in the field treatment had significantly higher survival (87%) than did those in the forest treatment (74%; $P= 0.0004$). The difference in survivorship was likely driven by water stress in the forest treatment. The soil moisture content in the forest treatment was 16%, while the soil water content was 26% in the old field ($P<0.001$). The

combination of a relatively dry summer with the water demands of the forest overstory led to increased mortality of seedlings regardless of cross identity, highlighting the importance of soil moisture during the first year of growth. Variation between the crosses may develop over time as the trees matures. We will begin to track seedling ecophysiology and growth rates over the next growing season, as their small size precluded these measurements the first year. Our longterm goals include determining the best large-scale replanting strategy and to determine if blight resistance comes at a cost of reduced growth rate.

266 - Potential facilitation by grasses of a rapidly expanding shrub on a coastal barrier island

Michael Sinclair, Julie Zinnert

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Barrier islands are important for coastal protection but are extremely vulnerable to sea level rise and increasing storm frequency and intensity. Rapid and extensive vegetation change has been observed on the Virginia Coast Reserve islands as swale grasslands are invaded by shrubs, dominantly *Morella cerifera*. The shrubs eventually displace grasses completely and form dense, monospecific thickets. Islands undergoing shrub expansion have also experienced a decline in island area, likely resulting from shrubs interrupting normal sediment movement across the island. Therefore, it is important to understand mechanisms driving this shrub encroachment. One factor may be facilitation during early stages of encroachment of shrub seedlings by grasses through protection from excess heat and solar radiation. My work examines facilitation by experimentally removing grass from plots with newly established *M. cerifera* seedlings and quantifying effects on seedling survival, growth, and physiological performance. Ground temperatures, photosynthetically active radiation (PAR), and leaf area index (LAI) are monitored to quantify microclimatic effects of grasses. Under grass canopy, leaf and soil temperatures and PAR levels are lower relative to open areas without grass. Light is more quickly attenuated as grass density increases. LAI is higher in grassy areas where seedlings are found. Grasses may encourage shrub seedling establishment by ameliorating harsh environmental conditions found on barrier islands. The interaction between the shrub and the grasses likely switches from facilitative to competitive at some point. My research serves as the beginning of a long-term study in which the shrub seedlings will be tracked through their life stages to observe when this shift occurs. The fast transition from grassland to thicket, often occurring in only 15 years, and the impacts that this vegetation shift has on island sediment dynamics, make understanding this process important.

267 - The Characterization of Leaf and Bark Fungi Isolated from Different Reproductive Stages of American Beech in a Forest Affected by Beech Bark Disease

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During the past two years we have been examining American Beech regeneration and beech tree health in a forest in Northeastern Pennsylvania that has long been affected by Beech Bark Disease. As part of this study, we did a limited survey of the fungi associated with beech leaves (collected from seedlings, sprouts and saplings) and the bark from disease affected trees and saplings. Leaf samples were collected early (June) and later (September) in the growing season. Isolated leaf disks were surface sterilized and plated on potato dextrose agar, whereas bark samples were directly plated on the same medium to isolate fungi. Fungal isolates were identified in part by morphology, but more so on DNA sequence analysis of the internal transcribed spacer (ITS) region of nrDNA and specific protein coding regions such as translation elongation factor 1-alpha. A greater number of isolates were obtained from the September leaf samples than the June samples. However, the number of different fungal taxa was similar, but was distinctive for the most part between the two sampling periods. The

genera identified from the bark samples were different from than those isolated from leaf samples except for Fusarium. The sequence analysis and identified fungi will be discussed as well as possible relationships to beech health and regeneration.

268 - Black cherry seedling growth is negatively affected by simulated herbivory and soil collected from large black cherry trees

Christopher Pendergraft, Benjamin Ramage

Randolph-Macon College, Ashland, VA

Current research suggests that tree seedlings are negatively affected when growing in soil from mature trees of the same species ("conspecifics"), and are also inhibited by insect and mammal herbivory. However, research to date has not investigated whether larger conspecific trees have a greater effect on seedling growth, or whether there are interactions between herbivory and soil effects. This study examines how black cherry (*Prunus serotina*) seedlings are affected by: a) soil collected from the base of black cherry trees spanning a range of sizes, and b) simulated insect and mammal herbivory. Sixty pots were filled with sterile potting soil and three seedlings were planted in each pot. One-quarter of a cup of soil from mature conspecific or "heterospecific" (different species) trees were added to each pot and then covered by more sterile potting soil. Within each pot, each seedling was assigned to an herbivory treatment: insect herbivory (one-half of each leaf cut off), mammal herbivory (stem cut above the first two true leaves), or a control. Larger cherry trees were found to have a negative effect on seedling growth when compared to larger non-cherry trees and smaller cherry trees. Herbivory reduced seedling growth but there was no differential effect between cherry and non-cherry treatments. This study demonstrates that both herbivory and conspecific soils each have their own effects on seedlings. Future research should more thoroughly investigate the biota that accumulates under larger mature conspecific trees and how these organisms interact with herbivory.

269 - Fire-Regime Management in Western North Carolina

Mandi Miller

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Records of forest fire disturbance are relatively short (~50-100 years) in many regions across the southeastern United States. For much of the southeast, the historical fire records only cover approximately the past 50 years. Therefore, there is a need to develop proxy records of fire history to better understand the natural variability of fire regimes. This research will attempt to develop proxy fire histories using bog sediment records collected in Western North Carolina in the Southern Appalachian Mountains. Understanding the fire history will help to identify the underlying controls of the local fire regime, and to determine how ecosystems have responded to past changes in climate so that this information can be used to improve land-use and forest management plans in the future. Records of fire activity were determined by analyzing sedimentary macroscopic (>125 µm) charcoal preserved in the sediments of the Panthertown Valley Wetland Complex in Sapphire, NC. The sediment records were dated using 14C dating at Woods Hole - National Ocean Sciences Accelerator Mass Spectrometry (NOSAMS) facility, MA. Analysis of the regions fire histories will inform decision makers about the management of forest resources and guide the use of prescribed fire as a management tool in the region.

270 - Changes in Ant Biodiversity Across an Urban Gradient

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University of Tennessee at Chattanooga, Chattanooga, TN

Urbanization is defined as the growth of cities in terms of outward expansion, vertical growth and population growth. The purpose of this study is to document changes in ant diversity in Chattanooga, Tennessee. The hypothesis is that ant diversity would decrease with higher levels of urbanization as indicated by the percentage of surrounding impervious surface. Overall, we found eleven different species of ants. Initial findings show that the park habitat type is more highly diverse with nine species, the street edge habitat has seven different species, and the street median was the least diverse with only five species. *Solenopsis* was the most abundant followed closely by *Tetramorium* and *Monomorium sp.* All three species are considered highly invasive and are known to displace native species. As of now, the current data gathered supports the hypothesis. The parks, which represent areas with lower levels of urbanization, had greater species diversity than the street edges and medians, areas with higher levels of urbanization, which had less species diversity. Additionally, it should be noted that the species of ants that are considered invasive were only found in the street median habitats. Chattanooga is just one of many cities in the southeastern United States undergoing rapid growth. In addition, the transition from city to forest is very prominent in the Chattanooga area. The data collected from this study will help enhance our understanding of the effects of urbanization by presenting a glimpse at how the biodiversity of a species, in this case ants, can change as the levels of urbanization change. Using that information, comparisons can be made to other urban environments to further study the effects of urbanization. Studying the changes in biodiversity will become important for monitoring the ecological functions of locations similar to Chattanooga that are experiencing rapid urbanization.

271 - Role of the Soil Seed Bank in Wildfire Response

Kelder Monar

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Wildfire can create favorable growing conditions for vegetation that survives the fire's destructive effects. One means through this filter is the persistent soil seedbank. To determine potential seed bank contribution to post-fire regeneration, I monitored germination in the greenhouse from soil and litter samples taken from burned (B) and unburned (U) plots at three sites. I also collected data on standing vegetation at these plots. Preliminary results indicate seedbank richness and abundance are greater in U plots. However, in the field richness and abundance of seedlings were greater in B plots. Overall, site-specific and species-specific results to date suggest that fire can shift the vegetative community toward the seedbank community under some conditions.

272 - Hyperaccumulators and Herbivores: Effects of an Agromining Monoculture on Invertebrate Communities and Ecosystems

Grace McCartha, A. Joseph Pollard

Furman University, Greenville, SC

Hyperaccumulators are plants that contain extraordinary concentrations of heavy metals in their aboveground tissues. Agromining is a novel biotechnology involving cultivation of hyperaccumulators to concentrate and harvest valuable metals. The effects of a hyperaccumulator monoculture on herbivorous insects and other invertebrates are essentially unknown. In a first attempt to investigate this interaction, we collected invertebrates from a pilot study of nickel agromining using the hyperaccumulator Alyssum murale on serpentine soils in Albania. Samples were collected by sweep-netting 50-meter transects. For comparison, we also collected samples from Vicia sativa (vetch), planted in the same field as a cover-crop, which does not accumulate nickel. Invertebrates were sorted into morphospecies and community density and diversity statistics were calculated. Samples were then acid-digested and analyzed for Ni and Fe concentrations using atomic absorption spectrophotometry.

Invertebrate density was ~6X higher on Vicia than Alyssum. This is consistent with elemental defense, a hypothesis that hyperaccumulation has evolved to defend plants against herbivores. However, this conclusion requires caution – the nitrogen-fixing Vicia may simply be more nutritious and attractive to herbivores. Invertebrate species richness was 3X higher on Vicia than Alyssum, but simple richness statistics are confounded by sample size. Correction by rarefaction or by calculating measures of diversity such as Shannon and Simpson indices indicated no significant difference in invertebrate diversity between the two plant species. Mean Ni concentration was >3X higher in samples from Alyssum, but one particular transect was responsible for most of this difference. The same sample also showed extremely high Fe, which is abundant in serpentine soil but not hyperaccumulated by Alyssum. This suggests that soil contamination of invertebrate samples may explain the elevated Ni, rather than dietary enrichment. This preliminary study yielded inconclusive results, but will hopefully pave the way for future research and indicate potential pitfalls to be avoided.

273 - The role of a permeable sand column in modifying tidal-creek geochemistry and land-derived inputs to the coastal ocean

Nicholas Legut, Angelos Hannides

Coastal Carolina University, Conway, SC

As the urbanization of our coastlines continues, an increasing amount of terrestrial nutrients, contaminants, and pathogens will enter the coastal ocean. Coastal regions are characterized by high-energy, sandy beaches, and therefore permeable columns can exchange material at an accelerated rate with overlying water. Advective forces (i.e. surface waves, bottom current velocities) can transport dissolved and particulate materials into permeable sediment where they can be remineralized by microbes through aerobic and anaerobic processes. Ripples and other bedforms can enhance advective transport by creating a pressure field akin to Bernoulli's Principle. The geochemical zonation of nutrients and metals within the sediment therefore is changed by this mechanism and can result in anoxic porewater upwelling downstream of bedforms, while oxygenated water penetrates upstream of bedforms. Singleton Swash is an open-basin swash located in Long Bay, South Carolina, and acts as a conduit of stormwater runoff from nearby wetlands and urbanized areas and groundwater into the coastal ocean. Due to the high sedimentation and complex geomorphology of Singleton Swash, the open-basin portion of the swash acts as an intertidal circulation cell, and is subject to enhanced advective forces, thus increasing the reactive transport during flood tide. We plan to measure physical characteristics such as permeability and average channel velocity to understand the flushing mechanism within the porous sediment. We will measure the concentration of chemicals in water and sediment to determine if materials are retained within the swash. Finally, we will measure indicators of biological activity, such as organic matter content and chlorophyll a, to evaluate the response of the biological community to geochemical variations. Upon completion of this study we hope to demonstrate how exchange between the sediment and overlying water affects swash-water geochemistry, and thus the impact of land-derived substances, such as nutrients and contaminants on the coastal ocean.

274 - Adaptation of Soil Judging to Turkey

Rustem Fatih Albayrak, Elena Mikhailova, Christopher Post, Mark Schlautman

Clemson University, Clemson, SC

Soil Judging provides a framework for field identification of soil types, their properties, and interpretations for use. The adaptation of Soil Judging in Turkey can be beneficial to students as well as government agencies and the private sector. The objective of this study was to adapt Soil Judging methodology to Turkey by translating and adapting soil judging materials to make them applicable to Turkey. There are three main type of soils: *Zonal (Laterit, Terra*

Rossa, Brown Forest, Podzol, Tundra, Desert, Brown and Chestnut Color Steppe, Chernozem), Intrazona (Halomorfik, Kalsimorfik, Vertisol, Rendzina), and Azonal Soils (Alluvial, Colluvial, Loess, Morens, Regosols). These newly developed training materials can improve soil education in Turkey and improve land use management by leveraging geospatial technologies to relay soil information.

275 - Experimental field trials of *Panax quinquefolius*: What environmental factors affect American ginseng growth?

Brooke Thompson, Amanda Leonard, Heather Griscom

James Madison University, Harrisonburg, VA

Panax quinquefolium, commonly known as American Ginseng, is a shade tolerant, herbaceous non-timber forest product found in the deciduous forests of the eastern United States. American ginseng's native range includes most of the eastern and central United States, however wild ginseng is becoming increasingly rare due to over-harvesting, loss of habitat, poaching, and wildlife browsing. This study analyzed experimental field trials to determine the optimal habitat for American ginseng growth. Soil type and aspects were used in a 3 x 2 factorial design. Therefore, it was hypothesized that there would be significant differences in ginseng growth (height, leaf area, reproduction, survival) due to aspect and soil type. It was predicted that leaf area, height, berries, and survival of three-year-old plants would be significantly greater in limed loam soil on north-facing slopes. The soil used for the study was collected from three forest sites: cobbly, sandy loam, fertile loam, and fertile loam that was limed. In the fall of 2014, 49 seeds were distributed amongst seven subplots in raised beds at six different sites. All beds were placed in gaps with approximately 30% light. Ginseng plants were significantly taller in limed loam soils ($p<0.001$) on northern aspects ($p=0.006$). They also had greater leaf area on limed loam soils ($p<0.001$). Survival was not affected by either of these factors. An understanding of how habitat conditions affect ginseng's growth will aide in ginseng reintroduction in national forests and private lands.

276 - The effect of management practices on forest succession after agricultural abandonment on Block Island, Rhode Island.

Christopher Coggin, Heather Griscom

James Madison University, Harrisonburg, VA

Understanding patterns of forest succession on oceanic islands will help advise management plans within New England nature preserves. This study will take place on Block Island, 13 miles off the coast of Rhode Island. The island has an intensive history of farming practices, which were abandoned in the 1960's . Since agricultural abandonment, conservation groups with different land management strategies purchased these areas. These management practices include mowing shrubland, planting native and exotic tree species, and protecting natural regeneration from human disturbance. Currently, there is no data on the effect of these active and passive management practices on forest succession. Woody vegetation will be inventoried along random transects within four sites that are approximately 60 years in age. The four sites are characterized as the following: site 1 was planted with exotic and native tree species and mowed after abandonment, site 2 was planted with exotic and native species but not mowed after abandonment, site 3 was not planted or mowed after abandonment, and site 4 was never converted to agriculture. All trees greater than 5 cm dbh will be measured (dbh) and identified within 10 meters of each transect. All saplings or shrubs (< 5cm dbh, > 1 m in height) will be counted and identified within 5 meters of the transect. Tree seedlings (10 cm to 1 m in height) will be counted and identified within 1 meter of the transect. Soil samples will be taken every 10 meters along the transects to identify the soil series according to the USGS

geologic survey. Woody species diversity is predicted to be greatest where native and exotic trees were initially planted and where shrubland has been suppressed with mowing.

277 - Post-fire soil CO_2 efflux in a Southern Appalachian forest

Kylie Thornburg, Olivia Arnold, Beverly Collins

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Wildfire can remove above-ground plants and litter, affect root growth, and alter soil microbial communities; all of these can affect soil CO_2 efflux. Low-intensity fire has been shown to increase soil CO_2 efflux in the first post-fire season; in contrast, high-intensity fire can decrease CO_2 flux due to increased microorganism mortality. We monitored soil CO_2 efflux in burned and unburned areas of a Southern Appalachian hardwood forest during the first growing season following low-intensity fall wildfire. Fire decreased litter depth and marginally decreased soil CO_2 efflux, especially in spring and summer. Overall, results suggest fire removed litter inputs for soil respiration, but likely will have only a short-term effect on soil CO_2 efflux in this wet Southern Appalachian forest.

278 - *Bombus sylvicola* genetic distribution and speciation across the Central Rocky Mountains

Isabel Sullivan, Jennifer Geib

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The Central Rocky Mountains are high elevation mountains that can isolate populations between mountaintops. This isolation can lead to an influx of genetic diversity within the *Bombus sylvicola* species as resources shift and form new niches thus causing subpopulations to emerge. As resources shift, habitat can be lost causing a decline in *B. sylvicola* populations. This study is looking at genetic changes as a result of the separation of subspecies due to mountaintop isolation. 500 *Bombus sylvicola* were collected at 9 sites with differing elevations per site. Bees were collected mostly 100m elevation increments per site to get a gradient along the mountains' landscapes. After collection, the bumble bees were identified to species and the non-focal species and queens were released. The focal species were transported in ethanol to Appalachian State University for DNA analysis. This analysis will consist of extracting tissue from the bees' abdomens and performing a genetic analysis of their micro satellite regions. These micro satellites will be compared across all bee samples to determine the relationship between different subpopulations (i.e. elevation gradients and/or sites). When the sites are compared, the effects of the risks involved with *Bombus sylvicola* survival (such as habitat isolation and resource shifts) can be determined.

279 - Provisional value of soil inorganic carbon in the contiguous United States

Garth Groshans II, Elena Mikhailova, Christopher Post, Mark Schlautman

Clemson University, Clemson, SC

Soil inorganic carbon (SIC) is a naturally occurring liming material that regulates soil pH within the landscape. One provisional value of SIC is based on the cost of commercial limestone needed to amend soil. The objective of this study is to assess the amount and distribution of SIC in the contiguous United States (U.S.) by depth, state, region, and land resource region (LRR) using data from the STATSGO (State Soil Geographic) database. A monetary valuation of SIC was calculated based on the average cost of commercial limestone in the U.S. When valuing SIC midpoint storage and midpoint content at depth, the comprehensive depth of 0-200 cm was valued at \$5.18T and \$0.70 m^{-2}, respectively, for the contiguous U.S. with a trend of SIC value increasing with depth. The states with the highest midpoint total SIC storage value ranked: 1) \$1.84T (Texas), 2) \$0.36T (New Mexico), and 3) \$0.33T (Montana), while the top

SIC content values ranked: 1) \$2.78 m^{-2} (Texas), 2) \$1.72 m^{-2} (Utah), and 3) \$1.35 m^{-2} (Minnesota). The regions with the highest midpoint total SIC storage value ranked: 1) \$1.95T (South Central), 2) \$1.23T (West), and 3) \$1.01T (Northern Plains), while the top SIC content values ranked: 1) \$1.80 m^{-2} (South Central), 2) \$0.82 m^{-2} (Midwest), and 3) \$0.63 m^{-2} (West). The land resource regions (LRR) with the highest midpoint total SIC storage value ranked: 1) \$1.10T (D), 2) \$0.93T (H), and 3) \$0.64T (M), while the top SIC content values ranked: 1) \$3.33 m^{-2} (I), 2) \$2.83 m^{-2} (J), and 3) \$1.59 m^{-2} (H). The localities with the highest midpoint total SIC storage and content of both region and LRR are analogous, which are found in the Southwest, Midwestern, West regions. The results of this study support the view of SIC as a valuable commodity and resource.

280 - Identifying new residential developments in a forested landscape using high-resolution satellite imagery analysis

Hamdi Zurqani[1], Christopher Post[1], Elena Mikhailova[1], Mark Schlautman[1], Julia Sharp[2]

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Land cover change is one of the most important issues facing the landscape of the Southeastern United States. Land use change impacts the natural environment and it is important to understand the location and rate of change in forested areas near rapidly urbanizing areas. The objectives of this study are to: 1) determine the classes and the distribution of land cover using classification of high resolution satellite imagery for the upstate region of South Carolina; 2) identify where forested areas have been converted to residential or industrial developments; and 3) discuss the potential impacts of land use change on this region. Rapid urbanization has occurred in the southeastern U.S. because of economic development and population growth. The challenge is to develop methodologies to quickly identify how the landscape is being altered as forested areas are developed. Remote sensing techniques using newly-available high resolution satellite imagery have great potential for providing up-to- date spatial information about the land cover change. In this study, a framework has been developed to regularly monitor land cover change using a new geospatial technology platform: Google Earth Engine (GEE).

281 - Sand Compaction and Ghost Crab Burrows: An Analysis of Morphology and Volume

Bailey Harding

Ecology of Coastal Fauna, Conway, SC

Beaches are areas of high levels of human activity, resulting in fluctuations of sand compaction. This alternation of the substrate may have a major effect on beach organisms, particularly ones that construct burrows. Ghost crabs, *Ocypode quadrata*, are a well-described indicator of beach health and environmental quality. However, there is still little known about how sand compaction, which is often affected by level of human activity, affects the construction of the burrows. The penetration depth (PD), shape, volume and length of burrows created by the ghost crabs were measured on three wave-dominated beaches along the coast of South Carolina. Two beaches had high levels of human traffic, and one beach was private with highly restricted access. Burrows were randomly chosen from the base of the dunes and the mid-beach zone above the high tide line. Plaster of Paris was mixed and poured into the burrow and left to set for approximately 45min to 1 hour. The PD of the burrows was found to correlate with the shape of the burrow, however, the PD did not correlate with the volumes or lengths. Complex burrow morphologies displayed a bimodal distribution in relation to PD, while simple morphologies correlated with intermediate levels of PD.

282 - Modeling the Effects of Land Use on *Bombus impatiens* Using Stochastic Landscapes

William Vannoy

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Bumble bee populations worldwide are declining, and there is now widespread recognition that recovery and maintenance will require the conservation of resources required by the bees, particularly floral (food) resources. Land management regimes, particularly mowing, of lawns, roadways, and wild meadows impacts flower yield in such areas and thus the total resources available to for foraging bees. This study will examine the consequences of management ('mowing') of roadside and old meadow habitats of the Southern Appalachians for a locally abundance native bumble bee, *Bombus impatiens,* using a combination of ecological and modeling methods. I will establish twelve transects, each 20 M2, during Spring and Summer, 2018 on land managed by Blue Ridge Parkway, North Carolina. Roadside and meadow transects will be sampled weekly for abundance of known floral hosts of *B. impatiens*. The transects will be randomly assigned to one of two mowing frequency regimes or a control . Nectar production rates of flower species will be sampled weekly for duration of their season. Abundance and nectar data will be used to generate potential floral landscapes under different mowing regimes and to model the impacts of this on *B. impatiens*. Floral cover maps generated in ArcMap will produce rasters of floral data with dimensions 2km x 2km that are representative of study area and will undergo modeling scenario in R to determine potential impacts of mowing on *B. impatiens* using known parameters. Preliminary floral abundance for roadside data collected during late Summer, 2017, on unmanipulated transects, provides a baseline for comparing annual variation in floral abundance. Observations suggest that meadow management is likely to have a larger effect on *B. impatiens* than roadside due to differences in area and flower composition. Ultimately this study could provide valuable insight into potential impacts on pollinators that occur due to foliage management policies.

283 - Unmanned Aerial Vehicle (UAV) based thermal remote sensing to assess soil moisture

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Unmanned Aerial Vehicle (UAV) mapping of the spatial distribution of soil temperature may allow the estimation of the amount of soil moisture. The objectives of this study is to compare sensor-measured soil moisture with an UAV-derived soil temperature map. Preliminary results indicate that locations with higher soil temperature appear to have lower soil moisture, while areas of lower soil temperature have higher average soil moisture. The use of UAV based thermal remote sensing is used to assess soil moisture which may help understand plant moisture stress in the landscape. Thermal images from this UAV platform allow rapid assessment of soil temperature, while sensor based soil moisture measurements allowed the comparison of soil moisture with surface soil temperature. The UAV-based measurements can provide a soil moisture map over various spatial scales, where it may not be possible to collect data in a traditional way.

284 - Leaf anatomy, morphology, and life history strategy of *Hydrocotyle bonariensis* growing on a southeastern (USA) barrier island

C. Joell Bates, Amanda Richards, Thomas Hancock

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Barrier islands of the southeastern United States are considered a physically controlled, harsh environment. Only a small, select suite of plants have traditionally been able to tolerate these extreme conditions. Within this small suite, plants exhibit a variety of functional groups or

forms. An interesting species that can be found in several habitats within the barrier island ecosystem is Hydrocotyle bonariensis. Hydrocotyle bonariensis is a C3 perennial that almost exclusively grows via runners although it does produce copious amounts of flowers in the summer and tiny seeds in fall. The present study was conducted along an eight-mile stretch of uninhabited barrier island at Fort Fisher State Recreation Area in NC (USA). The purpose of the study was to document the presence and relative importance of H. bonariensis in the barrier island environment and explore strategies the plant uses to exploit the landscape. Data collected included species presence and cover, biomass allocation, leaf anatomy and morphology. It was determined that H. bonariensis is a minor but important component in the barrier island environment with increasing presence in all habitats progressing from the foredune to the backdune. Reproductive structures were most commonly found in the foredune. There was a general trend in increasing leaf area and petiole length and decreasing stomatal frequency from foredune to shrub habitat. These results were used to develop a conceptual model of H. bonariensis life history strategy in the barrier island environment of Fort Fisher, NC.

285 - Abundance and distribution of microplastic particles in Winyah Bay, South Carolina

Dillon King, Jane Guentzel, George Boneillo

Coastal Carolina University, Conway, SC

The prevalence and impacts of microplastic pollution in marine environments is an emerging concern world-wide. Sources of microplastics include manufactured microplastics and degradation of larger consumer plastic products. These small particles float near the surface of the water and do not degrade rapidly. Microplastics can transport toxic contaminants throughout ecosystems and are easily ingested by aquatic organisms. The consumption of these particles can be harmful to organisms by causing endocrine disruption, slowed growth rates, blocking of the digestive tract and entanglement. Winyah Bay is a large estuarine system that receives freshwater input from the Waccamaw River, Sampit River, Black River, and Great Pee Dee River. Winyah Bay flows into the South Atlantic Bight which borders the subtropical North Atlantic Gyre. The objective of this study was to quantify the abundance of microplastics in Winyah Bay and the surrounding rivers throughout an 8-month time span. Additionally, this study compared microplastic sampling techniques. Water samples were collected using plankton nets with two different mesh sizes (153 and 333 micron), and whole water samples were collected to determine potentially underestimated size fractions of microplastics using net sampling techniques. Microplastic concentrations found in whole water samples ranged from 0 to 28 particles per liter of water and 97% of the plastics identified in the samples were filamentous. Additional results from this study indicated that microplastic concentrations can be underestimated using net sampling techniques. The amount of plastic particles present were, on average, 94,000 times lower in samples collected using the 333 micron net than whole water samples and 14,000 times lower for samples collected using the 153 micron net.

286 - The effects of aerosolized and direct contact e-liquids on oral bacterial growth

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Per reports from the World Health Organization (WHO), electronic cigarettes (e-cigarettes) are similar to traditional cigarettes and are often displayed as aids to quit smoking, or as healthier alternatives to tobacco. E-cigarettes have quickly gained popularity by many people across the globe, since it hit the market in 2004. It is therefore important to determine the effects of e-liquids, not only on humans but also on human oral bacteria. This study aims to determine if e-liquids, of these e-cigarettes are detrimental to bacteria commonly found in the human oral cavity. In this study, we exposed various concentrations of e-liquids with and without nicotine

(0mg, 6mg, 12mg, and 24mg) to bacteria. The three test bacteria were: *Lactobacillus acidophilus, Streptococcus mitis,* and *Streptococcus mutans*. In our aerosolized exposure study, when we exposed *L. acidophilus* to 24mg nicotine e-liquid, there was an average of 9±5 cfu. In our direct contact study, *L. acidophilus* was exposed to the highest concentration of nicotine at 24mg, we observed an average inhibition of 21±3mm. These results were similar for all other bacteria. In conclusion, growth of bacteria will decrease after exposure to various concentrations of e-liquids. In both our aerosolized and direct contact study, we found that e-liquid does have some impact on oral bacteria and appeared to be species specific. Currently, there are no standard regulations on the use of e-cigarettes in the interest of public health. The results from this study, will help in establishing parameters for regulatory purposes.

287 - Adaptive significance of homing in the limpet *Siphonaria pectinata*

Ana Rodriguez, Terence Farrell

Stetson University, DeLand, FL

Organisms have physiological, morphological, and behavioral defenses against predation risks. The limpet *Siphonaria pectinata* exhibits "homing" behaviors, and it has been found that a relative maintains the same home scar for several months. I used rocky intertidal substrate adjacent to a seawall along the Indian River in Volusia County, Florida to test whether the limpets exhibit homing behaviors. I marked fourteen limpets to determine whether they return to their home scars. Twenty-one percent of the limpets remained on their home scar after six weeks. I used a randomized block design experiment within which focal limpets that had all nearby conspecifics removed were compared to an un-manipulated control treatment to test the hypothesis that limpet density and the intensity of intraspecific competition would reduce homing behavior. I successfully reduced limpet density by 77% of the limpets, but there was no statistically significant effect of the density reduction on the proportion of limpets that homed. This suggests that the homing behavior was not strongly influenced by the intensity of intraspecific interactions.

288 - Ultrasound Study of Reproductive Structures in Nesting Australian Flatback Sea Turtle, *Natator depressus.*

David Rostal[1], Janice Grumbles[1], Sabrina Fossette-Halot[2]

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The Flatback sea turtle, *Natator depressus*, is the least studied of all the sea turtles. It is found only in the waters of Australia and is considered phylogenetically one of the older extant sea turtles. We studied the reproductive structures using non-invasive ultrasound to determine ovarian follicle size and oviductal egg size and overall reproductive condition. Fifteen turtles were examined between Nov. 18th and 22nd, 2017 on Thevenard Island, Western Australia. In turtles that false crawled, we were able to identify oviductal eggs and collect egg size prior to nesting. During this period, 12 nesters displayed mature ovaries while 3 displayed partially depleted ovaries. Atretic follicles of various sizes were observed in several females. This was a pilot study to determine efficacy of the procedure as well as to collect data to compare with other sea turtle species. The Flatback sea turtle produces the largest ovulatory follicles of any Chelonidae.

289 - How a higher benthic species biodiversity may be indicative of good out planting sights for *Acropora cervicornis and Acropora palmata* in Roatan. Honduras.

Raquel Gilliland

Stetson University, DeLand, FL

Acropora cervicornis and *Acropora palmata* are important hermatypic corals in the Mesoamerican barrier reef. Within the past few decades there has been a large decline in their populations due to various environmental stressors and diseases. *Acropora corals* have also been found to be successful in nursery settings for later reef out planting to help conservation efforts. Surveys were conducted in Roatan, Honduras to look at the benthic surroundings of *Acropora palmata and Acropora cervicornis* as in indicator of biodiversity. Measurements were taken around a one meter radius of *Acropora* colonies. Videos, photos, and an invertebrate survey were taken to look at the number of different species surrounding each *Acropora* specimen.. The focus was on the most common species found in Roatan; species of gorgonian, sponges, hard corals, and cyanobacteria. The Simson's diversity test was used to compare *A. cervicornis* to *A. Palmata*, and comparing each sights diversity to one another. There was significant difference between healthy *A. palmata* and unhealthy *A. palmata* but not between healthy and unhealthy *A. cervicornis*. As high biodiversity is indicative of a better out planting sights the data was then used to make decisions as to where future out planting sights may have a higher survivorship than our current sight which had a significantly lower biodiversity than the other surveyed sights.

290 - Biodiversity of coral species from coral rubble at Cahuita National Park Costa Rica

Abigail Spahr, Deirdre Gonsalves-Jackson

Virginia Wesleyan University, Virginia Beach, VA

Cahuita National Park, a marine protected area (MPA) established in 1999, is located on the Caribbean coast of Costa Rica. This area, consisting of a fringing reef with an extensive beach area covered with coral rubble, has suffered from pollution and runoff from nearby rivers. The purpose of this research was to assess and document the current biodiversity of corals from the extensive coral rubble present along the coast of Cahuita National Park. Coral rubble, pieces of dead coral that have broken off of the main reef and washed ashore, can provide a baseline level of biodiversity of coral species from the nearby fringing reef. Coral specimens were collected from the rubble and species and abundance were documented. Results indicate a rich biodiversity of coral species consisting of 9 species with 32 specimens collected. Comparisons of collected species were made with those previously documented in the literature record. The implications of preserving biodiversity in MPA is also discussed.

291 - Genetic Insight into Dispersal and Reproduction of the Invasive Barnacle *Megabalanus coccopoma* in the Southeastern USA

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Invasive species are a significant conservation concern given their contribution to native species decline. The barnacle, *Megabalanus coccopoma,* is a common invasive species in tropical and subtropical regions of both the Pacific and Atlantic oceans. Little is known about the life history and ecology of *M. coccopoma*, and data on dispersal and reproduction could provide valuable insight into its propensity to establish introduced populations. A growing number of studies have shown that benthopelagic species show kin aggregation at local scales despite potential for larval mixing and dispersal. Most species of barnacle (including *M. coccopoma*) are hermaphroditic, but self-fertilization is rare. A recent population genetic study of introduced *M. coccopoma* populations in the southeastern US showed high levels of genetic variation but more homozygosity than expected. Kin aggregation and self-fertilization are two possible explanations for this pattern. The purpose of this study is to test for kin aggregations and self-fertilization in *M. coccopoma* using highly variable genetic markers. Barnacles connected in small clusters were genotyped and levels of relatedness were calculated. Larvae were also collected from the mantle cavity of mature barnacles that were isolated from any

potential mates. Multi-locus genotypes of larvae were compared with maternal genotypes to detect the presence or absence of non-maternal alleles. Preliminary data revealed minimal kin aggregation and that the offspring of isolated adults had allelic contributions from more than one parent. These results indicate that isolated barnacles are reproducing, but not by self-fertilization. Other mating mechanisms such as spermcasting may be utilized by isolated *M. coccopoma* individuals.

292 - Barcoding Lionfish Last Meal - A Citizen Science Project for the Classroom

Sherri Andrews[1], Nancy Pham[2]

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Barcoding lionfish last meal is a project that engages students in authentic research that uses molecular techniques to study an environmental issue - invasion of the lionfish. Lionfish, Pterois volitans, are a voracious invasive species indigenous to Indo-Pacific waters that are decimating coral reef ecosystems. We report the initial data gathered by students from high schools and universities and high school teachers attending professional development workshops. Data was shared on iNaturalist site to allow access for analysis. The project continues in its third year.

293 - SharkCam video observations of a marine fish assemblage associated with hard-bottom habitat of North Carolina

Tyler McKee, Nicholas Coleman, Erin Burge

Coastal Carolina University, Conway, SC

In August 2014, View Into the Blue (VITB), Teens4Oceans (T4O), Frying Pan Tower (FPT), and the Annenberg Foundation's Explore.org project installed a publically accessible underwater streaming webcam, SharkCam, at the Frying Pan Tower, 60 km off the coast of southeastern North Carolina. The camera installation and associated infrastructure are maintained by the partner organizations and volunteers. The camera is attached near the bottom in 15 m of water. The camera surveys the 3-dimensional structure that the tower legs represent and is adjacent to an expansive area of natural hard-bottom reef. Both these man-made and natural structures are important areas of high marine fish diversity. Public viewers, undergraduate students and professional researchers have so far identified 97 species of fish that frequent the area. The camera feed is available live over the web and has an invested public viewership. Since the project went live the camera feed has had over 918,000 public views, and the associated discussion forum has received over 44,000 comments. The camera is utilized for research by cohorts of students that data mine the archived footage for occurrence and relative abundance information on the fish assemblage. An identification guide book has been developed using still photos and excerpted video clips with detailed species descriptions, commonly confused species, and relative size and frequency of occurrence information. From over 500 video segments of 20 minutes each we have compiled approximately 8,000 occurrence records for 93 species of fishes. These records are being used to characterize the fish assemblage in terms of frequency of occurrence, seasonality, relative abundance (for 52 species), and environmental correlates. These observations will help describe fish community structure at Frying Pan Tower within the larger ecosystem and contribute to knowledge of diversity and abundance within the wider biogeographic region.

294 - Zoantharian abundance in benthic communities within the vicinity of human activities along the north eastern coast of Trinidad, West Indies

Stanton Belford

Martin Methodist College, Pulaski, TN

Zoantharians from genera *Zoanthus* and *Palythoa* abundance has been used in monitoring baseline studies in shallow subtropical and tropical coral reefs. Almost no studies have been conducted on marine litter in the Caribbean. Currently, anthropogenic effects are causing reefs to 'shift' from typically dominant hard corals to soft coral abundance. The Coral Video Transect (CVT) method was used to record zoantharian abundance at sites within close vicinity of direct human activities (marine litter, sedimentation, fishing), and sites away from human activities. Data will be collected during 3 month intervals over a period of 1 year. Zoantharian cover is usually higher in areas where low hard coral diversity is found, and areas where pollution and high sedimentation from human activity exist will have a higher probability of zoantharian abundance. Long-term monitoring can document changes in cnidarian benthic communities as coral reefs face an increase in direct anthropogenic effects.

295 - Eastern oysters (*Crassostrea virginica*): Oyster reef restoration and interstitial space

Bailie Lavan, Patrice Ludwig

James Madison University, Harrisonburg, VA

Eastern oyster populations, *Crassostrea virginica*, in the Chesapeake Bay have been historically decimated by overharvest, pollution, and disease. It has been well documented that current population numbers total less than 1% of their historic population and thus we know that the loss of natural shell reefs is imminent. While many restoration efforts are being focused on the structural shape and building material type of artificial reefs, very little, if any, research is being conducted on the effect of differing sizes of interstitial space on oyster recruitment and survival. Previous studies have concluded predictions stating the importance of interstitial space on predator-prey relationships occurring within oyster reefs; however, no practical method has been developed for quantifying this space. Quantifying interstitial space will allow us to capitalize on recruitment, and thus survival, of oysters by mitigating the effects of predation. This method would allow for an increase in oyster reef populations and therefore an increase in harvest and economic revenue, while additionally filling the knowledge gaps in quantifying interstitial space that exist across biomes.

296 - A comparison of hydrology and salinity in salt marshes and vegetative coastal-swales in North Carolina's Outer Banks.

Chloe Eggert, Mariana Kneppers, Brant Touchette

Elon University, Elon, NC

While *Spartina patens* and *Juncus roemerianus* are well characterized salt-marsh plants, their occurrence in coastal plains has received considerably less attention. Coastal plain systems consist of progradational landforms composed of elevated ridges and low-lying swales. The transitions between ridges and swales are steep and represent dynamic shifts between xeric and mesic systems. In North Carolina's Outer Banks, populations of *S. patens* and *J. roemerianus* are commonly found in low-lying swales where slight changes in elevation have profound effects on soil salinity and surface waters. Therefore, the purpose of this study was to characterize the hydrology and the salt environment of coastal swale systems that maintain populations of *S. patens* and *J. roemerianus*. These abiotic factors were compared against salt marsh wetlands that also maintained both species. Preliminary data suggests both swale wetlands and salt marshes receive environmental salt from the air. During periods of low wind velocity, salt deposition was comparable between the two systems. However, during high wind events, salt deposition was three times greater in salt marsh systems. Similarly, in sandy soils, both systems maintained comparable salt levels. In soils with pronounced organic content, however, salt marshes had a 16-fold increase in soil salinity. Finally, water table depths tended to be deeper in swale systems compared to salt marshes. While the hydrological and saline conditions are different between the two ecosystems, it is likely that salt aerosols and the

presence of a shallow water table are sufficient enough to maintain salt-marsh halophytes in coastal-swale communities.

297 - Acclimation to elevated salinities promotes photosystem II thermoprotection in salt marsh plants.

Mariana Kneppers, Brant Touchette

Elon University, Elon, NC

Abiotic components of coastal marsh systems are considered highly stressful for most angiosperms. Resident plants must contend with periodic flooding, reduced-anoxic soils, sand burial, high saline conditions, and high summer temperatures. Plant physiological behavior to multiple stressors is poorly understood and may involve intensifying or offsetting responses. Therefore the purpose of this study is to consider the interactions between salinity and temperature in three coastal marsh halophytes (*Spartina patens*, *S. alterniflora*, and *Juncus roemerianus*). In an experimental microcosm study, plants were acclimated to different salinities (0, 15, 30, or 45psu). Afterwards, plants were heat-shocked at selected temperatures (ambient, 40, 45, or 50°C). Chlorophyll *a* fluorescence was monitored on leaf tissues as a non-invasive tool used in characterizing perturbations in photosystem II (PSII). Common markers used in fluorescence studies to identify changes in PSII include potential quantum yield (F_v/F_m), effective quantum yield ($\Delta F/F_m'$), and chlorophyll *a* performance index (PI_{ABS}). Preliminary findings from this study suggest that individually elevated temperatures or high salinities promoted declines in quantum yield. However, when these stressors were combined, the higher salinities appeared to foster enhanced thermotolerance in *S. alterniflora* and *J. roemerianus* as evidenced by smaller changes in F_v/F_m and $\Delta F/F_m'$ at salinities of 30 and 45. Similar trends were also observed in $PI_{ABS,}$ however, thermotolerance behavior diminished at 50°C. This thermoprotective response was most pronounced in *S. alterniflora*. The findings from this study may help provide new insights into how coastal marsh plants may respond to higher summer temperatures attributed to climate change.

298 - Effects of sediment composition and light exposure on growth and diversity of benthic algae in restored salt marshes in southeast Virginia

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Restorations of tidal salt marshes in urban areas of the mid Atlantic are an increasingly adopted approach of reducing stormwater runoff, non-point source pollution and shoreline erosion. These restorations often involve the installation and planting of upland sands with characteristics different than the native tidal sediments. Prior studies have suggested that changes in sediment type may be associated with differences in the microflora and associated potential food quality. The microphytobenthos (microscopic algae associated with the sediment) form the base of the food web and are used in assessing restoration success and water quality in salt marshes. The study sites along the Lafayette River are restored tidal salt marshes in Norfolk Virginia completed in 1997 (Larchmont Library), 2009 (Virginia Zoo) and 2013 (Colley Bay). *Spartina alterniflora* dominates the intertidal zone in the mid to southern atlantic including the chosen study sites. Sediment treatments of upland restoration sand and existing sediment were replicated in each site. Light measurements were taken during sampling at or directly above treatments. Microphytobenthos samples were collected weekly over 5 weeks and analyzed for phytoplankton species and abundance using light microscopy. Sparsely vegetated areas with greater light exposure yielded higher densities of diatoms including *Nitzschia, Navicula, Bacillaria* and *Pleurosigma* species relative to the shaded areas which were dominated by cyanobacteria species such as *Pseudanabaena* and *Oscilattoria* spp. Understanding the effects sediment type and shading have on microphytobenthos

composition can lead to a more complete view of trophic structure and ecosystem functions in evaluating restoration success.

299 - Age, Growth, and Reproductive Life History of the Gobiid fish *Gobiosoma bosc* in the Charleston Harbor Estuary

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University of Charleston, SC, Charleston, SC

Gobiosoma bosc is a cryptic, short-lived goby abundant in shallow coastal habitats, oyster reefs, and estuaries throughout the northwestern Atlantic ocean from New York south to southern Florida, excluding the southern tip of Florida, and along the coast of the Gulf of Mexico to Campeche, Mexico. Previous studies on the life history of G. bosc failed to include age determination using otoliths or histological analyses to describe basic reproductive phases, therefore basic knowledge of its population demographics and reproductive biology remain nearly unknown. The aim of the current study is 1) to determine the age and growth for individuals of all size classes for both sexes of G. bosc; 2) determine the duration of the spawning season and spawning periodicity for populations within the Charleston Harbor; and 3) describe the reproductive phases both seasonally and developmentally. Specimens were collected monthly using oyster shell trays, seine nets, dip nets, and hand collections from three sites within the Charleston Harbor beginning May 2017 and will continue until August 2018. Prior to fixation, sagittal otoliths will be removed for aging and growth determination. Formalin-fixed dissected gonad tissue and surrounding viscera will be sectioned and sequentially mounted to obtain a full cross-sectional series of the gonad and accessory gonadal structures. Histological verification of mounted sections will provide information about reproductive phases across the lifespan of G. bosc populations in the Charleston Harbor. Results from the study will provide data necessary for population assessments of G. bosc and their ecological role within oyster reefs and estuarine ecosystems.

300 - The influence of localized ecological variables on southern Appalachian salamander populations

Jasmine Williamson[1,2], Kayla Allen[1,2], Cory Duckworth[1,2], Todd Bennett[1,2], Katelyn Shook[1,2], David Patterson[1,2], Jessica Patterson[1,2]

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Amphibians are an essential group of organisms for understanding ecological dynamics due to their acute sensitivity to temperature, precipitation, and other environmental variables, as well as their vital role in forest floor communities. Northeast Georgia is an important region in the study of amphibians, particularly salamanders, due to the elevated diversity of plethodontid salamanders in the southern Appalachian Mountains. In this study, we utilized drift fences paired with pitfall traps to survey local salamander populations in two forest sites adjacent to Hurricane Creek in Lumpkin County, Georgia to investigate the effects of biotic and abiotic factors on diversity and ecology. Prior to constructing our drift fences, we implemented a point quarter tree survey method to quantitatively assess differences in vegetation cover in two areas of our locality. A portion of forest dominated by planted loblolly pine was compared to one with heterogeneous hardwood diversity. We monitored our traps daily over a 90-day period and collected ambient temperature, soil temperature, air humidity, light intensity and soil pH data. Our findings indicate that our two localities differ in salamander community composition, but are similar in terms of most of the abiotic variables that we measured. These findings indicate that extremely localized biotic and abiotic variables influence salamander distribution in northern Georgia.

301 - Mesopredator Occurrence Across an Urban to Rural Gradient in Central Appalachia

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Urban developments are causing changes in ecological communities across the globe. Within terrestrial systems, the removal of apex predators by humans has resulted in the phenomena of mesopredator release, in which populations of mid-sized predatory mammals have increased. In this study, sets of camera traps were used to assess relative mesopredator activity and richness across a gradient of anthropogenic impact. Cameras were deployed at three natural areas managed by Eastern Kentucky University; our study also considered within site variables related to trail proximity and bait presence. Thus, our analysis addressed the habitat differences related to the gradient of human presence at broad and fine scales. Results contradict the Intermediate Disturbance Hypothesis by showing a greater mesopredator presence at the urban, early-successional natural area, and the lowest level of mesopredator occurrence found at the natural area dominated by second-growth forest. The natural area with old growth forest was found to have an intermediate level mesopredator occurrence. Further research across gradients of disturbance will aid in predictive species modeling and create a better understanding of mesopredator release.

302 - Tracking Cicada Susceptibility to Fungal Infection in Urban Habitats

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Urban ecosystems have immediate consequences on insect population fitness, directly affecting organisms' ability to fight infection as well as the presence of pathogens in the environment. Specifically, the occurrence and diversity of entomopathogenic fungi are expected to vary in response to environmental changes associated with urbanization. In an attempt to better understand the effects of urbanization on cicada-fungi interactions, we collected sample populations from a highly disturbed urban habitat (rest stop) and an undisturbed forest habitat during the 2017 Brood VI periodical cicada (*Magicicada spp*.) emergence. We surface-sterilized and then dissected the air chamber, ventriculus, intestines and reproductive organs to isolate entomopathogenic fungi. We plated the tissues on rose agar plates. After a five-day incubation period, we examine the isolated fungi present in those tissues. Our preliminary data indicates fungal presence primarily in the reproductive organs and air chamber of cicadas, vital organs which greatly affect the cicada's fitness.

303 - Distance Modeling of Avian Species in Lilley Cornett Woods, Kentucky

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Old-growth forests in the eastern United States are rare and typically small in size, yet serve as best available reference sites for studies of the impacts of disturbance. In ecology, research methods producing widely applicable and multi-faceted data are preferred because of their conservative use of time, energy, and money but high quantitative output. One such method frequently utilized by ornithologists is distance modeling, which allows estimation of density and the ability to relate it with environmental characteristics. We studied the bird communities of an old growth forest in central Appalachia, and modeled density of birds in relation to environmental factors including disturbance and forest type. Point counts were conducted during June 2017 at 34 sites within Lilley Cornett Woods, a mixed mesophytic forest with over 200 acres of old growth in southeastern Kentucky. The data of the seven most abundant species were analyzed using Program R, Package Unmarked. Responses to disturbance were

heterogeneous but species-specific, as were preferences for habitats with or without Eastern Hemlock. Both Blue-headed and Red-eyed Vireos were found in higher densities in areas disturbed by roads or trails, whereas Hooded Warblers and Tufted Titmice tended away from those disturbances. Black-throated Green Warblers, Hooded Warblers, and Acadian Flycatchers preferred areas without Eastern Hemlock, but both species of Vireos tended towards increased hemlock density. The varied responses speak to the importance of forest heterogeneity and complexity, but also suggest that even minor disturbances occurring in areas receiving the highest levels of protection can impact densities of birds and thus affect bird community composition. Findings from this study have implications for the management of Lilley Cornett Woods and may help prioritize strategies to favor biological richness and diversity.

304 - Changes in the Occurrence and Diversity of Fungal Entomopathogens across Tennessee Soil Types.

Rachel Ayers

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Fungal entomopathogens are found in soils where they are known to infect and eventually kill insects. Fungi are sensitive to environmental conditions such as moisture and temperature, and these factors are expected to vary with climate change and soil conditions. Specifically, moisture is expected to vary with the different components within the soil such as silt, clay, and sand. The aim of our study is to observe and understand how abundance and diversity of fungal entomopathogens vary across the different soil types in Tennessee. We collected soil samples from five physiographic regions (Gulf Coastal Plain, Western Highland Rim, Central Basin, Cumberland Plateau, Valley and Blue Ridge) that vary in soil components. We then used a mealworm baiting technique to isolate entomopathogenic fungi. We expect to find a higher occurrence and diversity of fungi collected from the Gulf Coastal Plain due to higher moisture compared soil collected in mountain regions. Understanding how the occurrence and diversity of these fungal entomopathogens vary will provide insight into how they change across landscapes.

305 - Species Richness Within An Urban Coyote (*Canis latrans*) Territory

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A common assumption in the southeastern United States is that coyotes (*Canis latrans*) are non-native species that negatively impact biodiversity either via a trophic cascade or competitive exclusion. For example, the Georgia Department of Natural Resources recently cited “the impact of predation on native wildlife” as justification for lethal coyote management and the implementation of the Georgia Coyote Challenge. We investigated vertebrate community composition within an urban coyote territory in Atlanta, Georgia for 20 consecutive months to investigate these potential links. Our study site consisted of approximately 1.2-ha within an 8-ha mixed pine-hardwood forest bisected by a small creek and surrounded by housing development. An active coyote den was first detected at the site in March 2016. Remote cameras were placed throughout the study site beginning in May 2016, and they were in continuous operation for the duration of the study. Trapping effort (# of cameras deployed x # of days deployed) averaged 78.7 days per month. Over 700 coyote images were obtained, coyotes were detected in every month, and 2 litters of pups were born and raised. Coyote images were most commonly captured between 6:00 - 8:00 and 20:00 – 22:00 hrs. Contrary to a paucity of native wildlife, we found high vertebrate species richness (n = 16) in conjunction

with a resident urban coyote group, including bobcat (*Lynx rufus*), red fox (*Vulpes vulpes*), North American river otter (*Lontra canadensis*), and least weasel (*Mustela nivalis*).

306 - Analysis of Camera Placement for Vertebrate Surveys and Other Ecological Studies

Hunter Cox, Byron Burrell, Matt Estep

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Camera trapping has become a popular tool in studying populations over large spatial scales. Many methods have been developed to improve the accuracy of cameras, and as the use of these methodologies expand, we see a need to dive further into how the placement and angle of a camera can affect the data collected. Our design was to deploy 4 cameras in a single location for 2 weeks at a time. Two of the cameras were placed above the normal vegetation height, and two were placed below the normal vegetation height. A single camera from each of the heights was tilted at a 45° angle towards the ground. This design was repeated at 6 locations. The locations for each deployment were generated through ArcGIS and covered a number of habitats and elevations of up to 5400 ft. Results from this camera trap study will be presented to further refine the effectiveness of camera trapping.

307 - Latitudinal variation in interactions of Partridge Pea, *Chamaecrista fasciculata,* with defensive ants and herbivores

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Latitudinal gradients are known to influence abiotic and biotic interactions, particularly when measured as species diversity. Other aspects of biodiversity are expected to follow similar trends, but these have been studied far less. Variation in functional traits may give species opportunities to fill un-utilized niche space, facilitating local adaptation. For plants, herbivory can influence individual's fitness, and plants put much energy into defense. Given the latitudinal gradient recognized for herbivorous species, biotic interactions between plants and herbivores should increase, and plant defenses are expected to be greater at lower latitudes. In this study, we examined latitudinal variation in functional traits and plant interactions with defensive ants. We conducted this study on *Chamaecrista fasciculata* due to its ecological diversity and variation in leaf pubescence, which may influence herbivore interactions, and flowering time, which may influence fitness. If there is a latitudinal gradient of plant-ant interactions, then we predicted that diversity and abundance of ants would be greater at lower latitudes, and that variability in ant-plant mutualism would influence functional traits and herbivory experienced by *C. fasciculata.* Plants were observed at 10 locations from 30 to 34 degrees latitude over two periods in 2017. Data were collected on plant height, number of stems, leaves, and flowers, leaf damage, and seed germination. Ants and herbivores were collected for identification of species. All functional traits varied by latitude. Even with potentially increased herbivory, leaf damage was lower in lower latitudes. Germination rates were higher at lower latitudes. This suggests that ant defense was stronger along a decreasing latitudinal gradient. Ant abundance, but not ant diversity increased with decreasing latitude. Given that functional traits of *C. fasciculata* and interactions with ant species vary along a latitudinal gradient, there is potential for the evolution of local adaptation in plant interactions with other species of their communities.

308 - An assessment of a glacial relict population of *Pinus strobus* (Eastern white pine) in the Uwharrie Mountains of North Carolina

Morgan Elder, Kara Cline

Catawba College, Salisbury, NC

A previous management plan assessed the status of an isolated Eastern white pine (Pinus strobus) population in the Uwharrie Mountains of the North Carolina Piedmont in 2012. This small population contained only 32 trees and is located in a microclimate on a steep north facing slope above a perennial stream. This Eastern white pine population is important because it may represent the southernmost piedmont stand in the southeastern United States. This population is isolated from the primarily Appalachian Mountain distribution of Eastern white pine, in the southeast, and is assumed to be a glacial relict. The previous study indicated a low rate of regeneration with only one tree less than ten years old and no seedlings. The objective of the present study is to assess the current condition of the white pine stand in order to infer the population's trajectory. The population condition is assessed by census using GPS coordinate data from the previous study, diameter at breast height, age estimates using tree-ring counts, and a seedling survey. Due to hardwood competition the population is in decline. However evidence of recruitment was shown through new seedlings on exposed mineral soil from recent prescribed fires.

309 - 28-year demographic study of *Trillium pusillum* var. *pusillum*

Brian Owens, Danny Gustafson, Joel Gramling, Richard Porcher

The Citadel, Charleston, SC

Trillium pusillum Michx. var *pusillum* (Carolina least trillium, dwarf trillium) is a perennial, rhizomatous spring flowering herb that is a Federal Species of Concern and listed as state endangered in Kentucky, North Carolina, and Tennessee. The largest known population in South Carolina occurs in Francis Beidler Forest in Dorchester County. In 1989 Hurricane Hugo significantly damaged the canopy structure, increasing light reaching the understory, altering the microhabitat, and potentially impacting this rare *Trillium*. In 1990, Dr. Richard Porcher established four permanent 25 m^2 plots to monitor *Trillium* demography. The Citadel Ecology class has collected single leaf, triple leaf, and flowering data (1 m^2 subplots) over the course of 24 spring surveys during peak anthesis. During the intervening 28 years of data collection, this swamp forest has experienced numerous hurricanes, tropical storms, ice storms, and significant flood events. Initial analyses indicate an increase in the number of flowering individuals following a natural disturbance to the canopy and this positive effect on sexual reproduction may last more than one season. There was no significant increase in the single leaf growth stage estimates; however, triple leaf and flowering growth stage showed significant increases over time. Increasing light reaching the forest floor appears to stimulate *Trillium* growth and reproduction, with some positive demographic responses occurring in subsequent seasons. Furthermore, interannual variability in *Trillium* response at this site suggests that other factors such as microsite elevational differences influencing soil moisture content and the unique dynamics of ant-dispersed *Trillium* seeds may also be impacting demography at small spatial scales.

310 - Effects of Female Condition on the Reproductive Success of Eastern Bluebirds (*Sialia sialis*) Breeding in West-Central Georgia

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We are studying the effects of female condition on the reproductive success of Eastern Bluebirds (*Sialia sialis*) breeding in west-central Georgia. We are assessing female health using heterophil to lymphocyte (H:L) ratios, hematocrit (i.e., proportion of packed red blood cells), female mass and tarsus lengths, and the presence or absence of endoparasites in their blood. Reproductive success is quantified as the number of fledglings, the average mass of each female's brood at the time the nestlings were banded, and tarsus lengths of the nestlings.

Blood samples and reproductive data were collected from females breeding in nest boxes on the main campus of Columbus State University (2015-2017), as well as boxes located at Callaway Gardens in Pine Mountain, Georgia (2015). In total we are analyzing 61 blood smears that were fixed in methanol and stained with a Hemacolor stain set. To obtain H:L ratios we quantified and identified 100 leukocytes as either lymphocytes or heterophils using a 1,000x oil immersion lens. We are using linear regression to compare the female health metrics to the reproductive success of each female bluebird. We are also using one-way analysis of variance to compare female health and reproductive parameters between early-breeding and late-breeding females. We predict that female bluebirds in poor health will nest later in the breeding season and will have lower reproductive success than females in better health.

311 - The hidden language of plants: Making sense of VOCs and plant defense

Joshua Kraft, Carol Baskauf

Austin Peay State University, Clarksville, TN

Plants utilize various defensive strategies against herbivores, including physical and chemical deterrents as well as indirect methods such as attracting herbivore predators using volatilized organic compounds (VOCs). It has been shown in some plants that induced defenses can be primed by VOCs released during herbivore attack. These compounds act as an airborne messenger to alert neighboring plants or more distant parts of the same plant to "prepare" to make defensive compounds. Passiflora incarnata is a vining plant that contains cyanogenic compounds in its leaves to help ward off herbivores, although some specialist herbivores are resistant to those toxins. Passiflora incarnata also produces extrafloral nectar to attract ants, which could defend the plant against various types of herbivores. This study examined whether 24 hours of proximity to an herbivore-attacked neighbor (potentially releasing VOCs) induced greater extrafloral nectar production and/or inhibited leaf consumption when “VOC-exposed” plants were attacked by herbivores and whether responses differed based on type of herbivore, either a specialist (S) or a generalist (G) herbivore. Mean nectar production values were 0.81 uL/nectary (S+VOCs), 0.45 uL/nectary (S no VOCs), 0.705 uL/nectary (G+VOCs) and 1.00 uL/nectary (G no VOCs). The mean amounts of leaf area consumed were 9.35 cm2 (S+VOCs), 6.69 cm2 (S no VOCs), 3.93 cm2 (G+VOCs)4.76 cm2 (G no VOCs). No significant differences in leaf area consumed and extrafloral nectar production between herbivore type or exposure to VOCs were found. We conclude that 24 hours of proximity to herbivore-attacked neighbors had no significant effect on induced defensive compound production in P. incarnata in our experiment.

312 - Acoustic monitoring and geographic analysis of bat populations in Florence, SC

Cassidy Mahoney, Aaron Robinson, Travis Knowles, Jeff Steinmetz

Francis Marion University, Florence, SC

In this study, bat populations in Florence County were monitored over a period of thirty-three months and geographically analyzed by species. This population data was collected using a bioacoustics monitoring system. The Wildlife Acoustics Echo Meter Touch provides spectrograms and auto-identification of bat calls from different species. For the Pee Dee region of SC, the Echo Meter Touch auto-identifies nine species of bats. Based on the bat calls recorded, all nine species were collected. The most commonly detected species were *Lasiurus borealis* (Eastern red) and *Nycticeius humeralis* (Evening bat). Activity along a twenty mile route was measured approximately every two weeks at the peak time of activity. The numbers of recordings collected in the study were higher in the summer and fall compared to the winter. The route was chosen to include different habitat types, including residential, commercial, industrial, agricultural, and forest. The different habitat types were determined with a

combination of ArcGIS provided by Florence County and ground truthing. Once habitats were determined, species calls were separated based on location. This data was then analyzed to determine whether certain species preferred certain habitats.

313 - Comparing the genetic structure and gene flow barriers of two alpine bumblebees (*Bombus balteatus* and *B. sylvicola*) in the central Rocky Mountains

Kaitlyn Whitley

Appalachian State University, Boone, NC

The intermountain Western US has experienced significant environmental impacts from climate change over the last 50 years, creating novel challenges for species that occupy these areas. Metapopulation theory predicts that extant populations with greater interconnection via dispersal and gene flow should be more likely to withstand such environmental challenges, exhibiting greater likelihood of persistence. This projects aims to investigate the relative extent of genetic connectance among populations of *Bombus balteatus* and *B. sylvicola,* two ecologically important native bumblebee species in alpine habitats of the Central Rocky Mountains, Colorado. These species historically comprised over 95% of samples captured in the region during the 1960s-70s but have experienced declines in their relative abundances in recent years. This decline has likely been facilitated by climate-mediated declines in available floral resources coupled with increased competition from upwardly mobile lowland *Bombus* species. We first examine population genetic structure using microsatellite markers and then use geospatial modeling to determine how various landscape features (i.e. elevation, precipitation, land-use, etc.) influence dispersal and gene flow by correlating genetic distances to landscape resistance distances, which are computed using the connectivity modeling program Circuitscape. *B. balteatus* and *B. sylvicola* are both restricted to high elevations (>3,500 meters), yet differ in tongue length and body size, which may influence their dispersal ranges. Comparisons of these two species sampled from identical elevations and study sites may elucidate differences in how they are able to disperse across the landscape and exchange genes. Comparing how the population genetic structure of these two alpine bumblebees is influenced by various landscape features should allow for prediction of relative probability of persistence. Populations at high elevations typically experience relatively strong genetic drift and population structuring, so conservation management strategies should be directed to the populations that are most at risk of low genetic diversity and isolation.

314 - Pigment profiles of purple, green, and spotted morphotypes of crane-fly orchid, *Tipularia discolor*

Brooke Willans, Heather Francis, Nicole Hughes

High Point University, High Point, NC

Crane-fly orchid (*Tipularia discolor*) is a perennial, terrestrial orchid native to woodlands of the eastern United States. At least three different morphotypes occur sympatrically in the Piedmont of North Carolina, producing a solitary leaf that is either adaxially green, purple, or green with purple spots. All three morphotypes exhibit bright purple lower (abaxial) surfaces, and faint reddening during leaf expansion. The objective of this study was to use microscopy and analytical chemistry to characterize foliar pigment content and histology in each of the three leaf morphotypes of *Tipularia discolor*. Preliminary results suggest that different anthocyanins are responsible for adaxial/abaxial purpling, and yet another is responsible with juvenile reddening. The morphotypes do not significantly differ in concentrations of other photopigments (chlorophyll, carotenoids), consistent with previous studies reporting similar capacity for photosynthesis among the three types.

315 - A survey of *Aspergillus* species in beach sand and the corresponding water column of commercial and private beaches in South Carolina.

Olivia Cannon, Fang-Ju Lin

Coastal Carolina University, Conway, SC

Beach sand is a known reservoir of fungal species, some of which can cause illnesses in humans. Several species of the ascomycete *Aspergillus* are known potential human pathogens which can cause a series of conditions broadly referred to as aspergillosis. In order to determine the abundance of *Aspergillus* species between a commercial and private beach in South Carolina, sand and water samples were collected from Myrtle Beach and Waties Island over the course of four weeks during the summer. Samples were plated on Sabouraud's Dextrose Agar and incubated at 27°C until distinct colonies formed. Colonies were isolated and fungi were preemptively identified by macro- and microscopic observation, and DNA from isolates was sequenced for definitive identification. Preliminary data showed that sand samples from the Myrtle Beach study site contained *Rhodotorula, Aspergillus*, and *Penicillium* species, while none of these fungi were seen in samples from Waties Island. However, Waties Island samples did exhibit growth of colonies not seen in Myrtle Beach samples, potentially indicating a difference in species present between the two locations. Possible reasons for this discrepancy include environmental differences and differences in human presence and impact. This study contributes to the knowledge and understanding of potentially pathogenic fungi present in beach sand and water in Myrtle Beach, as well as the potential impact of human activity on the presence of these fungi.

317 - Lichen Biodiversity of the Redstone Arsenal, Madison County, Alabama

Curtis Hansen

Auburn University Museum of Natural History, Auburn, AL

Lichens were surveyed across nine ecologically sensitive areas of the U.S. Army's Redstone Arsenal in Madison County, Alabama. From a total of 466 collections, 147 species in 60 genera were identified, including twelve state records and two new species currently being described. Prior to this research, only eight lichen species had been documented from the Redstone Arsenal, thus most collections reported here represent new county records at a minimum. Interesting finds include *Cladonia stipitata*, *Hypotrachyna imbricatula*, *Parmotrema despectum*, *Physconia detersa* and *Thelidium decipiens*. Collections from this study represent the first comprehensive survey of lichens carried out on the Redstone Arsenal and will serve as a baseline for future studies.

318 - The Status of *Schwalbea americana* L. (Orobanchaceae) in Georgia

Richard Carter[1], W. Wilson Baker[2]

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Field surveys conducted in Georgia for federally endangered *Schwalbea americana* L. (chaffseed) resulted in identification of 10 metapopulations in six counties of southwestern Georgia. All populations of this hemiparasitic perennial herb were found in longleaf pine-wiregrass savanna communities with a history of regular and frequent burning. Data were recorded on numbers of individuals in each metapopulation, associated species, and other environmental attributes. Populations were ranked based on habitat quality and other factors. Permanent plots were established to enable long-term monitoring of populations and to acquire quantitative data on chaffseed and associated species.

319 - Bringing up the bottom: Collection biases may skew plant species richness measurements in Poinsett County, AR.

Travis Marsico, Jennifer Reed

Arkansas State University, Jonesboro, AR

Collection biases, including species bias, infrastructure bias, and the botanist effect, can lead to misrepresentations of species richness and distribution, which can complicate conservation planning. These collection biases, when paired with areas that are already thought to have poor species richness, can mean that certain regions are poorly studied, leading to misrepresentations of known species richness. One such area is the Mississippi Alluvial Plain or "Delta" region of Arkansas, which has undergone drastic vegetation and land-use changes at the hands of settlers and modern residents. Additionally, previous specimen collection effort has been poor. As a result, the Delta region should have a higher species richness of vascular plants than currently recognized. The objectives of this study are to: 1) create a complete list of vascular plant species, 2) map all previous plant collections, and 3) determine which type(s) of collection bias have affected plant species richness measurements in a Delta county, Poinsett County, Arkansas. After two field seasons, we collected 1,916 specimens over the course of 35 field trips. Of these specimens, we have found 106 new species records for Poinsett County. Already emerging from the developing dataset is a species bias against monocots including sedges and orchids. With a third field season and additional collections this number will increase and more biases will be revealed.

320 - Thinking outside the Crops: Mapping Vascular Plant Species Richness in the Anthropocene

Dylan DeRouen, Travis Marsico

Arkansas State University, Jonesboro, AR

With Homo sapiens now driving climatic and geologic processes that are reshaping the terrestrial biosphere, we have entered a new epoch known as the Anthropocene. Soon, all of Earth's wild ecosystems will be altered by human-induced stresses such as land use change, climate change, pollution, and nonnative species invasions. Current strategies used for ecosystem monitoring, such as ecoregions, oversimplify the impacts of human influence on terrestrial biota, especially in areas of high human disturbance (e.g., urban centers and agricultural intensive lands). With human-disturbed ecosystems becoming more prevalent in the near future, the ecological implications of our influence should no longer be overlooked. Anthropogenic biomes have emerged as a new way to assess and describe ecosystems in their human-altered form, and have the potential to be an essential tool in the future of ecology. This study aims to: 1) Assess vascular plant richness and composition across four Level IV ecoregions that were delineated using only geomorphological events and 2) Develop a local-scale anthropogenic biome for agriculturally dominated landscapes based on vascular plant richness and composition. These aims will be addressed by conducting classic county floristic inventories in the underexplored Crittenden and Mississippi Counties of Arkansas. Of the 2892 known plant taxa in Arkansas, Crittenden County has vouchers available for only 349 taxa (State rank: 75/75 counties), and Mississippi County has vouchers for 487 taxa (State Rank: 73/75). The low botanical species richness reported in these counties is likely due to the extensive agricultural landscapes that dominate the Mississippi Alluvial Plain Level III Ecoregion, which may have negatively impacted native species occurrence and has discouraged botanists from thoroughly exploring the area. To date, one collection trip has been made to the research area, which resulted in 78 collections and at least four species not previously recorded in Mississippi County, Arkansas.

321 - The Genus *Calopogon* (Orchidaceae) in Mississippi

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Calopogon R. Brown in Aiton is a genus in the Orchidaceae, subfamily Epidendroideae, tribe Arethuseae, subtribe Bletiinae. There are 5 species distributed in eastern North America, primarily in temperate and subtropical regions of the southeastern United States. All 5 taxa described in *Calopogon* have been documented from Mississippi and are as follows: *C. barbatus, C. multiflorus, C. oklahomensis, C. pallidus,* and *C. tuberosus*. These occur in a variety of typically fire-prone wetland habitats, ranging from moist pine flatwoods, to hillside bogs and savannas, to localized seeps with *Sphagnum* moss, and open meadows along spring branches. Three species are of conservation concern. During April and May, 2015 and April and May, 2016, when plants were at anthesis, 7 trips were made to locate extant populations of *Calopogon* species and record habitat data. *Calopogon* specimens in the following herbaria were examined between May, 2015 and December, 2017: University of Mississippi (MISS), Mississippi State University (MISSA), University of Southern Mississippi (USMS), the Camp Shelby collection at USMS, Delta State University (DSC), Institute for Botanical Exploration (IBE), Mississippi Museum of Natural Science (MMNS), Southern Weed Science Laboratory (SWSL), The Crosby Arboretum, and personal collections of the first author. An artificial key and updated information on the distribution and habitats of the native Mississippi species will be presented. This research was partially supported by a Troy University Faculty Development Summer Research Grant, by National Science Foundation grant DBI-1203687, and by the Mississippi Museum of Natural Science Foundation.

322 - Curation, research, and outreach at Virginia Tech's Massey Herbarium

Jordan Metzgar

Virginia Tech, Blacksburg, VA

The Massey Herbarium is the largest herbarium collection in Virginia with 115,000 catalogued specimens. These holdings are dominated by vascular plants (108,000 specimens) and are also comprised of fungal, bryophytes, lichen, and algal specimens. We are a regional herbarium with over 60% of our material collected in Virginia. The southeastern and mid-Atlantic USA regions account for most of our remaining collections. We possess numerous new county and state records for the Virginian flora and our material has been cited in over 600 peer-reviewed publications that have received in excess of 12,000 citations. We are actively participating in digitization programs such as the SERNEC (Southeast Regional Network of Expertise and Collections) Portal. We are developing a robust outreach program based on virtual and physical interactions with the community. Our website (masseyherbarium.org) and social media presence (@MasseyHerbarium) allow us to interact with the public and advance botanical knowledge. We have also begun working with school groups, undergraduate organizations, and amateur naturalist societies in the collection, field, and classroom.

323 - *Dicerandra*: Understanding Ancestral Niches of a Narrow Endemic.

Andre Naranjo, Pamela Soltis

University of Florida, Gainesville, FL

Dicerandra (Lamiaceae) comprises 11 species (Dicerandra christmanii, D. cornutissima, D. densiflora, D. frutescens, D. fumella, D. immaculata, D. linearifolia, D. modesta, D. odoratissima, D. radfordiana, and D. thinicola,) endemic to the southeastern United States.

Species of Dicerandra are threatened or endangered and restricted to sand hill vegetation and a mosaic of scrub habitats, with some species (D. cornutissima, D. thinicola, D. immaculata, D. frutescens, D. christmanii, and D. radfordiana) being restricted to one or two sites in peninsular Florida and Georgia. Using locality and specimen data from iDigBio and other sources, we have applied ecological niche modeling (ENM) and niche equivalency testing to investigate shifts in abiotic niche space among species. Phylogenies were reconstructed using several plastid genes and ENMs were integrated in a comparative method workflow using the 'R' package 'phyloclim' to estimate ancestral environmental tolerances at each node. These results will be used to reconstruct ancestral niche spaces when sea levels and climate were markedly different. Niche conservatism will be evaluated based on these results and interpreted in the light of conservation concern for these rare plant species.

324 - Microsatellite Marker Development for the Labrador Tea, *Rhododendron groenlandicum* (Ericaceae)

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Rhododendron groenlandicum (Oeder) Kron & Judd (Labrador Tea) is one of 7 species within subsection *Ledum*. These shrubs and sub-shrubs are circumboreally distributed in cool, damp habitats on all northern continents. Evidence suggests that *R. groenlandicum* originated from an ancestral species that migrated from Eurasia and underwent complex reticulate hybridization. The current study focuses on microsatellite marker development for the widespread northern North American species *Rhododendron groenlandicum*. Using iNaturalist, Citizen Science allowed for the jumpstart of this project by enabling the collection of populations across the entire range of the species which were independently difficult to collect. Forty-eight primer pairs were designed using Illumina sequence data and screened for ease of amplification using seven *R. groenlandicum* individuals. The 16 primer pairs that produced the most vivid bands were then subjected to a polymorphism screen which included PCR amplification with the incorporation of fluorescent tags (NED, FAM, PET, or VIC) on the PCR amplicons. Following gel electrophoresis, the pool-plexed reactions were shipped to Georgia Genomics and Bioinformatics Core for genotyping. There, the fluorescent tags were excited with lasers and a chromatogram representing the allele was generated digitally and scored in Geneious v11.0.3. The resulting allele table was analyzed to characterize basic population genetic metrics and to explore whether allelic variability of the microsatellite regions deviated statistically from Hardy-Weinberg equilibrium assumptions. The developed markers underwent PCR-amplification in the remaining species from Rhododendron subsect. *Ledum* to anticipate their utility in related taxa. Preliminary data shows that 14 markers are polymorphic and that *Rhododendron groenlandicum* is diploid, however, ploidy may differ among populations and unpublished flow cytometry work is inconclusive. The final set of developed markers will bring clarity to questions including 'fuzzy' species boundaries and understanding the nature of putative hybridization events regarding the evolutionary history of *Rhododendron groenlandicum* and its close relatives.

325 - Sixteen Polymorphic Microsatellite Markers for the Flame Azalea, *Rhododendron calendulaceum* (Ericaceae)

Megan Haffner[1], Zack Murrell[2], Emily Gillespie[1]

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Sixteen polymorphic microsatellite markers were developed for *R. calendulaceum* (Michx.) Torrey, the 'flame azalea,' in order to address questions of the evolutionary dynamic among populations throughout its broad Appalachian range. Additionally, genetic evidence was

generated to determine this species' ploidy, which had previously been speculated based on morphological observations and chromosome counts. Using Illumina sequence data from one individual of *R. calendulaceum*, a microsatellite sequencing library was generated and then mined using MSATCOMMANDER 1.0.8 based on predetermined parameters to identify 48 potential markers and primer pairs for screening. The 48 potential markers were screened based on the production of uniform, appropriately sized PCR amplicons after gel electrophoresis; this generated sixteen markers used for population screening. Fluorescent tags (6-FAM, VIC, NED, or PET) were assigned to each marker. Sixteen markers were screened using three populations of *R. calendulaceum* spanning West Virginia, North Carolina, and Virginia. After PCR amplification and pool-plexing, the reactions were genotyped and resulting chromatograms were scored using Geneious v11.0.3. All 16 genotyped markers are polymorphic, and preliminary evidence also confirms that *R. calendulaceum* is a tetraploid species, as has been long suspected. The deciduous azaleas of *Rhododendron* subsect. *Pentanthera* (Ericaceae) are taxonomically challenging. Closely related species of azaleas can be difficult to differentiate, especially where their distributions overlap. In particular, *R. calendulaceum* and *Rhododendron cumberlandense* E. L. Braun (Cumberland Azalea) can be difficult to differentiate based on morphological and phenological characteristics. Environmental conditions such as altitude-determined flowering time can influence morphological observations, decreasing the reliably of morphology to conclusively identify *R. calendulaceum.* The sixteen developed markers can assess the genetic diversity among populations of *R. calendulaceum* and contribute to differentiation of closely related species, such as *R. cumberlandense*.

326 - Towards an Investigation of Inter-Population Differences in *Leavenworthia uniflora* (Brassicaceae)

Ashleigh Nelson, Ben Gahagen

Abraham Baldwin Agricultural College, Tifton, GA

Leavenworthia (Brassicaceae) is a relatively widespread genus that comprises eight species in the Midwest and southeastern United States. *Leavenworthia uniflora* is the most widespread species, ranging from western Missouri, throughout parts of Arkansas, Alabama, Georgia, Indiana, Kentucky, Ohio, and Tennessee, east to Virginia; a few populations being disjunct and separated by the Mississippi River and the Ohio River. A new population of *L. uniflora* was discovered in Shenandoah County, Virginia in 2012, which makes it the eastern most population in the widespread disjunct distribution. Previous research examined the genetic differences in the Alabama, Arkansas, Missouri, and Tennessee populations using the three molecular markers: *LUMINIDEPENDENS* (*LD*), internal transcribed spacer region (ITS), and a chloroplast spacer region (*psbJ-petA*). For this project, the Virginia population was sampled using the same markers and compared to the populations already published. In addition to the phylogenetic portion of this study, morphological differences were also assessed via morphometric analysis. Measurements were taken of vegetative and reproductive characteristics for all populations. Future additions include assessing molecular and morphological differences in Georgia, Indiana, Kentucky, and Ohio populations of *L. uniflora.* This research will serve as an investigation of whether the Shenandoah plants represent some remnant population from a time when the species was more widespread or did the Shenandoah County population arise as the result of long-distance dispersal from a western population.

327 - On the evolution and phylogeography of the southeastern species of the genus *Dalea (Fabaceae)* using a phylogenetic approach.

Thomas Diggs, Joshua Fuller, Desiny Moore, Clarke Miller

University of North Georgia, Oakwood, GA

The genus *Dalea* (Fabaceae) consists of approximately 160 species with a few species being geographically widespread, and most of the genus being endemic to restricted areas with calcareous substrates. A previous study (McMahon and Hufford, 2004) looked at the phylogeny of the tribe which *Dalea* belongs to, Amorpheae, and one other phylogenetic study (Diggs, 2013) has been conducted on several species in the genus itself, mainly from the mid-west and coastal plains of Alabama. This study focuses on the phylogeny and phylogeography of *Dalea* species from the Gulf Coastal Plain, including *D. carnea, D. carthagenesis var. floridana, D. feayi, D. pinnata var. pinnata,D. pinnata var. trifoliata, D. adenopoda, D. mountjoyae,* and *D. albida* compared to two species in the genus *Amorpha* (Fabaceae) a closely related genus. Phylogeny for *Dalea* will be determined by DNA sequences taken from the plastid *trnK/matK* intron, and the nuclear ribosomal ITS1, 5.8S, and ITS2, and compared to sequences obtained from previous phylogenetic studies of *Dalea* (Diggs, 2013). DNA from ITS1 on a all of specimens have been sequenced and analyzed, but sequencing and statistical analysis of the sequences still needs to be performed on *matk* introns.

328 - The *Isoetes flaccida* complex in the southeastern United States: unrecognized species diversity in southern Georgia and northern Florida

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Isoetes flaccida s.l., one of the earliest species of *Isoetes* described from the Southeast, is easily distinguished from other species in eastern North America by its boldly tuberculate megaspores. Until relatively recently, *Isoetes* featuring this megaspore ornamentation found in Florida, Georgia, and Alabama were considered members of *I. flaccida* (including some occasionally recognized infraspecific taxa). Since the late 20th century, cytologic and DNA sequence data have uncovered evolutionarily distinct individuals of *I. flaccida* in southern Georgia and northern Florida. Phylogenetic analysis of low-copy nuclear DNA sequences and whole chloroplast genomes shows non-monophyly of several lineages, suggesting they could be considered distinct species under a phylogenetic species concept. These include the diploid *I. chapmanii* (Jackson Co., FL), tetraploid *I. junciformis* (Tift Co., GA), and the proposed diploids *I. "snowii"* (Coffee Co., GA), *I. "learyensis"* (Calhoun Co., GA), and tetraploid *I. "altamaha"* (Coffee Co., GA). *Isoetes flaccida s.s.* is considered to inhabit coastal areas of Panhandle and Peninsular Florida. Further work is necessary to evaluate the hypothesis that any of these taxa are long-distance dispersals from South America, where other morphologically similar *Isoetes* exist.

329 - Microsatellite Marker Development for Appalachian Rockcap Fern, *Polypodium appalachianum* (Polypodiaceae)

Vishnupriya Kasireddy[1], Erika Mitchell[2], Zack Murrell[3], Emily Gillespie[1]

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Microsatellite markers were developed for a fern species native to eastern North America, *Polypodium appalachianum* Haufler & Windham (Appalachian Rockcap Fern), to facilitate investigation of the genetic diversity and phylogeography of this taxon and its closest relative and possible hybrid offspring, *Polypodium virginianum* L. (Common Rockcap Fern). Using Illumina sequence data and principles of bioinformatics, primer design was conducted using MSATCOMMANDER 1.0.8 software. The designed forty-eight primer pairs were then screened for their ability to amplify a single, clear band in seven *P. appalachianum* individuals. A subset of 16 promising markers were genotyped for a single population of 24 individuals from Alleghany County, North Carolina, USA in order to confirm the ploidy of *P. appalachianum* and to evaluate intra-population variability of each marker. The 16 markers were then used to

genotype two additional populations from the northern part of the range of *P. appalachianum* (Vermont and New Hampshire) in order to show inter-population variability as well as variability across the range of the species. Cross-species amplifications were conducted on *P. virginianum*, as well as several other closely related *Polypodium* species in order to demonstrate whether the markers developed for *P. appalachianum* are likely to be useful in closely related species. After scoring and analyzing the data from the first population, it was confirmed that the species is a diploid. Majority of the markers worked well and were identified as polymorphic, suggesting that they should be applicable for future studies in *P. appalachianum* as well as its nearest relatives.

330 - Studying Hybridization within the *Trillium erectum* Complex via Microsatellite Amplification

Anna McCormick, Taylor Gray, Kathy Mathews

Western Carolina University, Cullowhee, NC

The *Trillium erectum* complex is native to the Southern Appalachian region and contains six species. Each species in the complex possesses a distinctive set of characteristics, but intermediate individuals are also found. The members of the *T. erectum* complex are known to hybridize among themselves. This study focuses on three sympatric taxa of the complex and their putative hybrids: *Trillium erectum* L. var. *erectum* (red-flowered), *T. rugelii* Rendle (white-flowered), and *T. erectum* var. *album* (Michx.) Pursh (white-flowered). We are asking: Can microsatellite loci distinguish among taxa and be used to identify hybrids between them? Are more microsatellite alleles shared between populations of the same species, between species growing in the same location, or between species with the same flower color? To answer these questions, we generated allele data for these *Trillium* taxa growing in pure and mixed populations (12-20 samples per population) in western North Carolina. Specifically, we amplified two microsatellite markers (TC36 and TC69) developed from *T. camschatcense,* the Japanese sister species to the *erectum* complex. Fragment analysis of PCR products was performed and microsatellite alleles were identified by size variation using GeneMapper. Population genetics statistics were generated in the program GenAlEx. Both loci were highly polymorphic. In pure populations of *T. erectum* var. *erectum* and *T. rugelii*, each species had high heterozygosity and possessed unique alleles as well as different allele frequencies for shared alleles. Ongoing analyses include collecting data from a pure *T. erectum* var. *album* population and a mixed population of all three taxa, including putative hybrid individuals. This study will quantify gene flow among three taxa of the *Trillium erectum* complex and show whether gene flow is most closely correlated with taxon, location, or flower color.

331 - The phylogeography of the Southeastern Species of the Genus Dalea (Fabaceae) using a molecular approach.

Joshua Fuller, Thomas Diggs

University of North Georgia, Oakwood, GA

The genus *Dalea* (Fabaceae) consists of approximately 160 species with a few species being geographically widespread, and most of the genus being endemic to restricted areas with calcareous substrates. A previous study (McMahon and Hufford, 2004) looked at the phylogeny of the tribe which *Dalea* belongs to, Amorpheae, and one other phylogenetic study (Diggs, 2013) has been conducted on several species in the genus itself, mainly from the mid-west and restricted glade habitats of Alabama, Georgia, and Tennessee. This study focuses on the phylogeny and phylogeography of *Dalea* species from the Gulf Coastal Plain, including *D. carnea, D. carthagenesis var. floridana, D. feayi, D. pinnata var. pinnata,D. pinnata var. trifoliata, D. adenopoda, D. mountjoyae,* and *D. albida* compared to two species in the genus *Amorpha* (Fabaceae) a closely related genus. Phylogeny for *Dalea* will be determined by DNA

sequences taken from the plastid *trnK*/*matK* intron, and the nuclear ribosomal ITS1, 5.8S, and ITS2, and compared to sequences obtained from previous phylogenetic studies of *Dalea* (Diggs, 2013). DNA from ITS1 and *trnK*/*matK* from a majority of specimens has been sequenced, but statistical analysis of the sequences still needs to be performed using *MEGA7* and other software.

332 - Comparing the Georgia Endemic *Calycathus Brockiana (Calycanthaceae)* and *Calycanthus Floridus L. (Calycanthaceae)* using ITS and MATK

Katie Horton, Courtney Kitchens, Samantha Shea, Abby English, Clarke Miller, Thomas Diggs

University of North Georgia, Oakwood, GA

This project seeks to compare the genetic sequences of the native shrubs *Calycanthus floridus* L. and *Calycanthus brockiana* Ferry & Ferry using the nuclear ribosomal ITS region and the chloroplast matK marker. Currently Alan Weakley's *Flora of the Southern and Mid-Atlantic States*(2015) lists two species within the genus: *C. floridus* and the northeast Georgia endemic *C. brockiana*. The genetic analysis of the two purported species will allow us to suggest either that they remain separate species or that they be combined. As a secondary goal, the project will attempt to create a phylogenetic tree showing the relationship between the genera in the Family Calycanthaceae. *C. floridus* is a highly variable woody shrub native to the East coast of the United States. Due to the variance in the leaf shape, overall pubescence, and color of the flowers, the genus Calycanthus has been split into many different species (Small, 1933, Radford et al., 1968) and varieties outside of cultivation over the years and then grouped back together by various authors, so another secondary goal will be to specifically focus on *C. floridus* with the hope of determining if the genus is made up of many separate cryptic species of plant rather than one or two variable species.

333 - Assessing chromosome number and abnormalities in *Spiraea virginiana*

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Spiraea virginiana Britton (*Rosaceae*) is a federally-listed rare, clonal shrub that inhabits riparian zones within the Ohio River drainage. The species often occurs in areas of high disturbance and predominantly uses asexual reproduction to propagate from populations upstream. Although the species' known range suggests that sexual reproduction played an important role in its evolutionary history, sexual reproduction is currently almost non-existent. Pollination studies have shown that the species can produce fertile seeds; however, this has not been witnessed in wild populations. Determining the role of chromosome segregation is an important step towards understanding the sexual reproductive barriers experienced in this species, possibly allowing for updated restoration efforts to be introduced. Cytogenetic investigations were carried out on a Motic BA410E research microscope using acetocarmine. This study aimed to identify any chromosome abnormalities visible during meiosis that might be a contributing factor to sexual reproductive barriers within this species.

334 - Characterizing freshwater macroinvertebrate food webs using DNA-based methods

Benjamin Swartz, Cynthia Tant

Winthrop University, Rock Hill, SC

Aquatic food webs are complex, and their study can provide valuable information on movement of energy and nutrients through ecosystems. Most food web studies involve microscopic analysis of gut contents that can be time consuming, and many prey species lack

features that persist long enough in a predator's gut for taxonomic identification. The application of newer molecular-based approaches has the potential to provide previously unavailable resolution in aquatic food webs. We sampled and identified a variety of benthic macroinvertebrates at the Winthrop Recreational and Research Complex in Rock Hill, SC. Individuals from selected predator taxa were used either to create gut content slides to identify prey categories or to extract DNA from gut contents for a variety of analyses. DNA extracted from selected individuals was sent off for analysis via next-generation sequencing. DNA extracted from other individuals was amplified using PCR with group-specific primers to determine presence or absence of those taxa in predator guts. These comparative data will ultimately provide baseline taxonomic data on food web interactions in lake, wetland, and stream habitats at the Complex.

335 - The genetic and ecophysiological diversity of *Kalmia buxifolia* (sand myrtle) and implications of climate change.

Ellen Quinlan, Katherine Mathews, Beverly Collins

Western Carolina University, Cullowhee, NC

Kalmia buxifolia (sand myrtle, Ericaceae) is a woody, flowering shrub with a highly disjunct distribution across droughty, nutrient-poor sites, from high-elevation rock outcrops of western NC to the upper monadnocks of the NC Piedmont, pine savannas of the Carolina Coastal Plain, and the NJ Pine Barrens. Previous research found significant variation in *K.buxifolia* morphology, but no clear pattern of allozyme divergence among regions. We initiated research to: 1) Reconstruct the phylogeographic history of *K. buxifolia* to determine locations of glacial refugia, directions of postglacial colonization, and divergence time from the alpine sister species, *K. procumbens*; and 2) assess seasonal variation in water-use efficiency (WUE) between mountain populations, which receive much of their water through daily cloud immersion (fog), and coastal populations on deep sands. We hypothesized that there is geographically-based variation in cpDNA haplotypes and drought tolerance between mountain and coastal populations. We generated sequence data for four noncoding cpDNA regions from 15 populations of *K. buxifolia* across its range and from the sister species. Preliminary data show the cpDNA of *K. buxifolia* to be less variable than that of its sister species, but indicate a mountain origin of present-day populations. Such an origin is counter to previous hypotheses of a Piedmont origin and may suggest that there is still genetic diversity among mountain populations, which could facilitate selection for coast-like drought tolerance as climate changes. Following analyses will include CID to identify variation in WUE between regions.

336 - Microsatellite Markers for taxonomic and phylogeographic studies on Sand Myrtle (*Kalmia buxifolia*, Ericaceae)

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Kalmia buxifolia (Bergius) Gift & Kron, Sand Myrtle (Ericaceae), exhibits a disjunct distribution in the Eastern United States. Populations occur in the NJ Pine Barrens, in the Southern Appalachian Mountains, and in the Sandhills/Cape Fear Arch region of the Carolinas, with little geographic connection among these three areas. Biogeographically, this species (and its tripartite distribution generally) is poorly understood. Despite closer geographic proximity, the Mountain and Sandhills/Cape Fear Arch populations are rather dissimilar in terms of habitat, with mountain populations typically occurring on rock outcrops and Sandhills populations occurring in wet pinelands, making the coastal plain populations more similar in habitat to the more distant NJ pinelands. Plants also vary morphologically, with Southern Appalachian and NJ Pine Barren plants tending to be more mat-forming and Sandhills plants tending to be taller

and less dense in habit. Over the last 150 years, experts have recognized between one (currently) and three entities (e.g. Small, DeCandolle) at the species or variety rank. In order to develop microsatellite markers for *K. buxifolia*, a set of 48 species-specific primer pairs were designed from Illumina data. These primer pairs were screened for ease of PCR amplifcation and the most promising pairs were used to genotype 68 individuals across three populations from the New Jersey Pine Barrens, the Great Smoky Mountains National Park (Tennessee) and the sandhills of North Carolina. Cross-species amplifications were conducted on the sister taxon *Kalmia procumbens* (Alpine Azalea) as well as all other members of the genus *Kalmia*, in order to demonstrate to what extent markers developed for *K. buxifolia* are suitable for use in close relatives. These markers will facilitate downstream taxonomic and phylogeographic studies within *K. buxifolia* and possibly close relatives.

337 - Identifying and examining potential biological pathogens in a rural, Alabama primary elementary school.

Jason Floyd, Nicole Gallups, Dr. Lisa Ann Blankinship

University of North Alabama, Florence, AL

It is well known that bacteria and fungi contribute to the onset of illnesses among young children in the public education system. This is most normally attributed to transmission of microbes through close interpersonal contact among students; however, another likely cause of rapid disease transmission is poor air ventilation and filtration, which decreases a building's indoor air quality (IAQ). The goals of this Sick Building Syndrome (SBS) study are: 1) collect air samples from a rural, Alabama primary elementary school (School P), 2) identify which microbes are present in the air samples, 3) determine the relative number of microbes per cubic meter in School P, and 4) assess the antibiotic resistance of the identified microbes. Air samples will be collected and bacterial and fungal cultures will be grown on either bacterial or fungal specific media. Once cultures have been isolated they will be identified using the Biolog GEN III database (bacteria) or sent out for identification at Accugenix (fungi). A formula for colony forming units per cubic meter (CFU) will be used to assess the number of microbes collected within School P. Antibiotic resistance will be tested with each microorganism identified. Results obtained from the study will help School P improve its indoor air quality (IAQ).

338 - Antibiotic Resistance: Plasmid Transfer Among Bacterial Species Using Antibiotics of the Tetracycline, Cephalosporin, and Carbapenem Classes

Natalie Lindgren

University of North Alabama, Florence, AL

Antibiotic resistance makes the treatment of illness a constantly evolving obstacle in drug development. Under ideal conditions, antimicrobial drugs work by either killing bacterial organisms or inhibiting replication. However, bacterial species are able to improve their genetic composition through plasmid conjugation, enabling neutralization of, removal of, or protection from drugs. In a hospital setting, resistant pathogens lead to multi-drug resistant bacterial strains that endanger the lives of patients. The purpose of this project will be to study bacteria that exhibit resistance to antibiotics in the tetracycline, cephalosporin, and carbapenem classes and transfer that resistance to an antibiotic sensitive organism. Tetracycline antibiotics are commonly distributed broad-spectrum drugs. Cephalosporin antibiotics are specific to either gram-positive or gram-negative bacteria. Carbapenem antibiotics are used to treat multi-drug resistant organisms. Evidence of the genetic transfer will be monitored by PCR analysis for antibiotic resistance transfer through plasmid uptake or alterations to genomic DNA. The goal of this experiment is to determine the ability of a nonresistant bacterial species to develop

antibiotic resistance from a resistant organism and to identify whether the resistance gene is located on the chromosome or plasmid.

339 - Schoolwork makes me sick: identifying fungal pathogens in a rural Alabama elementary school

Nicole Gallups

University of North Alabama, Florence, AL

It has been reported that a typical elementary school child will be sick 8 to 12 times during the school year (CDC). Due to the lack of immune system and the close proximity, most of the kids have to each other throughout a school day promote the speared of various diseases; however, these are not the only factors. Since the 1970s indoor air quality (IAQ) a topic of interest because poor ventilation and filtration can increase disease transmission. Fungal pathogens in a primary elementary classroom in rural Alabama school (School P) will be identified in this work. Based on the poor ventilation of the classroom and qualitative observations, it is hypothesized that organisms such as *Aspergillus*, *Cladosporium*, *Alternaria*, and *Epicoccum* will be identified in the classroom (Qian et al., 2012). Air samples were collected by the door, vent, and window. Samples were allowed to culture for 10 days and then sub cultured. Samples will be assessed for the number of microbes collected at School P with formula for colony forming units per cubic meter (CFU). Biolog will be used for fungal identification.

341 - "Prevalence of Antibiotic Resistance in the Enteric Gut Flora of a Community of Domesticated Livestock in Southwest Virginia"

Casey Chaplin, George Argyros

Emory and Henry College, Emory, VA

This study aimed to determine the prevalence of antibiotic resistance in the enteric gut flora of domesticated livestock, specifically cattle (*Bos taurus*) and sheep (*Ovis aries*) in Meadowview, Virginia. Use of antibiotics for treatment of bacterial infections, as well as any antibiotic components in feed, can promote the evolution of antibiotic resistance. *Escherichia coli* is a common enteric bacterium that lives in the gut, with certain variant strains such as *E. coli* 0157:H7 that are pathogenic in both livestock and humans and is traceable in the feces. Fecal samples were collected to isolate the bacteria and determine the degree of resistance to commonly used antibiotics in the medical treatment and dietary management of sheep and cattle. The presence of antibiotic resistant bacteria in this community of sheep and cattle could also have significance regarding cross-species transmission in farm communities, including humans since the human gut flora is composed of many of the same species, thus these data could have impacts on human health and disease. A total of 90 fecal samples were collected, pure cultures of *E. coli* were isolated, and their resistance to 12 common-use antibiotics were tested utilizing the Kirby-Bauer disk diffusion method. Results indicated that in the cattle population, 43.9 percent were resistant, 8.6 percent were intermediate, and 47.6 percent were susceptible to the antibiotics tested. In the sheep population, 39.5 percent were resistant, 9.7 percent were intermediate, and 50.8 percent were susceptible to the antibiotics tested. The results showed that the two communities had a similar trend in antibiotic resistance which led to the conclusion that cross species transmission had occurred between them. Further identification to bacterial strain is necessary to assess whether pathogenic *E. coli* 0157:H7 is present in samples tested.

342 - A Comparison of Phytoremediation of Copper Contamination Using Two Aquatic Plants, *Alternanthera philoxeroides* (Alligator Weed) and *Nasturtium officinale* (Watercress)

Hannah King

Abraham Baldwin Agricultural College, Tifton, GA

The physiological comparisons observed between *Alternanthera philoxeroides* (Alligator Weed) and *Nasturtium officinale* (Watercress) show how copper contamination can affect each plant species differently. *A. philoxeroides* is a nonnative invasive species that has spread throughout the wetland ecosystem in the southern part of the United States where it has caused habitat alteration. *N. officinale* is an aquatic plant that is sensitive to relatively low amounts of pollution and is most commonly found in springs and shallow bodies of water. These two plants have different physiological responses to aquatic pollution where *A. philoxeroides* tends to be more tolerant than *N. officinale*. In order to measure plant stress due to copper exposure, a benchtop luminometer was used. When plants are stressed, oxidants increase inside plant cells, and to combat oxidants, plants produce antioxidant enzymes. The luminometer measures antioxidant enzyme production by injecting hydrogen peroxide into a crushed plant slurry and quantifying the resulting luminescent reaction. *A. philoxeroides* was found to have low antioxidant enzyme levels showing that it was not adversely affected by the concentrations of copper used in these experiments. *N. officinale* was found to have high antioxidant enzyme levels showing that this plant was negatively affected by the same copper exposures.

343 - Selection of Heavy Metal Hyper-accumulation Cell Lines Using Tissue Culture Techniques as a Tool of Phytoremediation of Heavy Metals Contaminated Ecosystems

Melissa Pell, Kristen Price

Dalton State College, Dalton, GA

Heavy metal pollution poses a serious threat to the environment. “Heavy metals” refers to more than 60 metallic elements of a density greater than 5.0 g/cm^3. Elevated concentrations of all heavy metals are invariably toxic to biota. This study is an attempt toward developing mercury (Hg) tolerant cell lines of *Nicotiana tabacum* (tobacco) using tissue culture techniques. Cell cultures were exposed to stepwise increase of Hg concentrations in culture media to select resistant cell lines and study the stability of resistance in the presence or absence of stress. The preliminary results indicate that the stepwise increase of metal concentration in the growth media increases the tolerance of the callus tissues to the toxic effect of Hg. These stress-tolerant cell lines will be used to generate tobacco plants capable of accumulating higher concentrations of Hg in the tissues, which may be useful to phytoremediate contaminated sites.

344 - Patterns of Genetic Variation in *Phlox glaberrima*/*Phlox carolina* Species Complex.

Maria Popa

Emory & Henry College, Emory, VA

The genus *Phlox* has been difficult to evaluate because of various genetic and morphological discrepancies. The species complex, *Phlox glaberrima/Phlox carolina*, is particularly problematic because both taxa occur sympatrically and have numerous overlapping morphological and ecological characters. As a result, this species complex has often been reinterpreted by taxonomists and questionably identified by field collectors. In consideration of this, we analyzed how biogeographic history might have influenced the genera lineage and diversification through the investigation of genetic variability over geographic space. Nuclear (ITS) and chloroplast DNA sequence datasets were developed in order to investigate the

relationship between *P. glaberrima* and *P.carolina* throughout most of their known distributions in the southeastern U.S. Phylogenetic and haplotype analyses found that morphological species designations did not explain genetic patterns in *P. carolina* and *P. glaberrima*. The nuclear phylogeny resolved two other species, *P. maculata* and *P. buckleyi,* within *P. glaberrima/carolina* suggesting potential hybridization between lineages. Additional research is needed to further investigate this occurrence. Haplotype analyses identified two major neighborhoods, with two populations from central Alabama located at a central and interconnected position, suggesting central Alabama as a potential center of diversification for the complex. Overall, this research aims to advance our understandings of the processes that have lead to the diversification within *Phlox* and inspire other studies to evaluate how ecology, geography, and morphology might have influenced evolutionary histories.

345 - Barn Owl Pellets as Indicators of Small Mammal Community Structure in Northeast Tennessee

Thomas Wolfe

Emory and Henry College, Emory, Virginia, VA

This study seeks to assess the utility of owl pellets as indicators of small mammal community structure in northeastern Tennessee. Analysis of barn owl (*Tyto alba*) pellets collected in 1997 from the movie theatre attic of the Veterans Affairs Hospital, Johnson City, Tennessee were dissected and small mammal species present were identified. The total minimum number of individual (MNI) small mammals from the assemblage totaled 160. The majority of prey present in the samples consisted of meadow voles, *Microtus pennsylvanicus* (n=122, 76.25%). Other species present, in decreasing relative abundance, were as follows: northern short-tailed shrews, *Blarina brevicauda* (n=29,18.125%), white-footed/deer mice, *Peromyscus* sp. (n=5, 3.125%), southern rock-voles, *Microtus chrotorrhinus* (n=1, 0.625%), and 3 unidentified individuals (1.875%). The final results from this analysis will be compared with published findings of traditional small mammal collection surveys (i.e., live and kill-trapped) conducted in the region to assess degree of similarity of small mammal community structure and relative abundance (i.e., percent composition by species). Data collection to date has consisted of morphological analysis of skeletal elements found in the pellets. Additional materials in the samples, such as bone fragments, loose teeth, and hair will be further tested utilizing *mtDNA* analysis. Molecular markers such as cytochrome b, COI, and the mitochondrial control region will be employed to determine the usefulness of molecular identification on material unidentifiable by use of traditional taxonomic keys. Future work in 2018-2019 includes the collection and analysis of new pellets as well as traditional small mammal trapping surveys in the area surrounding the VA Medical Center for comparative ecological analyses.

346 - The Genetic Identity of the Rare *Betula uber*

Anne Lenhart

Emory & Henry College, Emory, VA

Lenhart, Anne E. Eta Iota, Emory & Henry College. The Genetic Identity of the Rare Betula uber. A population genetic study was conducted evaluating the variance between three species of the Birch (Betulaceae). An investigation was made into the species' B. uber (Virginia Round Leaf), B. alleghaniensis (Yellow Birch), and B. lenta (Sweet Birch) using Amplified Fragment Length Polymorphism (AFLP). All three species grow naturally in the Smyth County region of Virginia. In the 1980's, the conservationist described B.uber as a morphologically distinct species of Birch trees and that need to be legally protected. Betula uber has been on the endangered species list since it's rediscovery in 1975 when only 40 trees were found in the Cressy Creek area. It still remains under the protection of conservation today. The individuals in this study were sampled from Cressy Creek, with 5 different

population sites of B. uber, number of individuals ranging n=10 to n=5. Samples of B.lenta and B.alleghanienis were also taken from Cressy Creak, Hidden Valley, Straight Branch, Commerce Road, and Middle Creek n ranging from 10 to 5. Enough samples were collected to fill a 96 well plate for the fragment analysis. The aim of this project is to help elucidate the relationship of Betula uber to the other two closely related Birches used in this study. There are no major conclusions yet; we hope this investigation will add to our knowledge, then we can inform the land mangers about appropriate resource allocations and management plans.

347 - Effects of tetracycline free base on the reproduction of the rotifer *Philodina acuticornis*

Rachel Lloyd

Erskine College, Due West, SC

Tetracyclines are antibiotics commonly used in agriculture and often contaminate aquatic communities through runoff. This study investigated the effect of tetracycline free base on the reproduction of the freshwater bdelloid rotifer, *Philodina acuticornis,* over 14 days. For each concentration of tetracycline and for the control, 6 wells on a 24 well tissue culture plate were stocked with 3 neonate rotifers each. The rotifers in each well were transferred to a new well with fresh media each day and eggs were counted. Tetracycline free base was added as a single application (SA) on the first day at concentrations of 25 mg/L, 50 mg/L, and 100 mg/L, and as a continuous application (CA) of 25 mg/L and 50 mg/L added daily. The results suggest that tetracycline has a negative effect on rotifer reproduction. CA treatments resulted in significantly depressed daily and total egg production per rotifer as compared to the control. SA treatments delayed peak egg production, but total egg production per rotifer was similar to the control. As suggested by related research, the negative egg production effects observed in the treated rotifers are possibly a result of a tetracycline-related decrease in bacteria as a food source.

348 - The effect of tetracycline on growth and nutrient consumption by the microalga *Scenedesmus*

Elizabeth Schneider

Erskine College, Due West, SC

Antibiotics, such as tetracyclines, are commonly found in natural water systems as a result of agricultural runoff. This has become a growing concern to environmental and human health because of the potential to disrupt ecological balances and increase bacterial resistance. Microalgae form the base of the food chain in aquatic ecosystems and are able to remove excess nutrients from agricultural and wastewater runoff. Studies have demonstrated symbiotic relationships between some species of aquatic bacteria and microalgae, as bacteria fix nutrient compounds into compounds that microalgae can efficiently metabolize. This relationship may be disrupted by the presence of antibiotics. In this experiment, the microalgae Scenedesmus was cultured in media containing various concentrations of tetracycline (0, 25, 50, and 100 ppm) and the effect of tetracycline on microalgal growth and nutrient consumption was monitored. Colorimetric reagents were used to measure the concentration of ammonia, nitrate, and phosphate in each sample over the course of the experiment to determine any correlation between tetracycline concentrations and the efficiency of nutrient removal by Scenedesmus.

349 - Effects of Severe Environmental Conditions on Remnant Longleaf Pine Survival

Malia Fincher[1], Emily Repas[2]

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Longleaf pine requires fire to sustain its natural habitat. Regular burning reduces leaf litter and the density of competitive species. Fire suppression from human interference with the natural habitat has contributed to the disappearance of the Longleaf Pine. Remnant populations still exist in small pockets across the southeastern United States. Here we show that the survival of remnant populations in Oak Mountain State Park in Pelham, Alabama is not driven by species or habitat, but it does appear that LLP experiences more variation in mortality among habitats than the other species. It also appears that post drought mortality is highly similar to post fire mortality. Due to the wide variability of environmental factors within a plot, further exploration of environmental variables may be necessary to determine which environmental variables are driving LLP survival. We anticipate this study to be the basis of further research attempting to determine how extreme weather conditions may drive LLP survival in the absence of fire.

350 - Quantifying the effects of the Dalton State College campus on leaf litter breakdown rates and the macroinvertebrate community of College Creek

Michael Cuprowski, Cody Beavers

Dalton State College, Dalton, GA

351 - Osteocyte Dendrite Morphology in a Low and High Strain Environment in the Primate Craniofacial Skeleton

Maria Balderas

Abraham Baldwin Agricultural College, Tifton, GA

The most prolific cells in bone, called osteocytes, have dendrites that lie in demineralized channels called canaliculi. Dendrites likely detect strain in the surrounding mineralized tissue. Dendritic morphology has been linked to differences in strain across different skeletal locations. Osteocyte dendrites found in the murine fibula were longer, but smaller in diameter and volume than those found in the calvaria. The “FITC-Imaris Technique” was used to reconstruct the complex 3D osteocytic network in a high strain (zygoma) and a low strain (supraorbital) region of the craniofacial skeleton of five humans and five chimpanzees. Measures of dendrite length, thickness, and number were collected for 20 cells from each individual. We hypothesized the low strain supraorbital regions of both species will contain shorter, thicker dendritic processes relative to the high strain zygoma region. Dendrites in the low strain supraorbital region of both species had significantly larger diameters ($p=0.003$) than those found in the high strain zygoma region. The dendritic processes in both regions were significantly larger ($p=0.000$) in humans than in chimpanzees. Our results support the hypothesis that differences in dendritic morphology are species and location specific, and that these differences reflect differences in the remodeling response of bone to its environment.

352 - Isolation and Culture of Microglia

Deanna Doughty, Natasha Venugopal, Jennifer Bradford

Augusta University, Augusta, GA

Glioblastoma (GBM) is the most aggressive and common adult brain tumor subtype, with the majority of patients surviving less than one year. The GBM microenvironment is composed of tumor cells as well as non-cancerous cells, such as microglia, a component of the immune system in the brain. To better understand the role of microglia in GBM, we have optimized *in vitro* culture conditions for primary microglia. Growing microglia in culture is challenging, but this technique is needed for planned future experiments. Microglia were isolated from mouse neuronal tissue by magnetic bead antibody cell separation using the cellular marker CX3CR1. Isolated microglia were then cultured in various culture conditions, and cellular morphology by light microscopy was used to determine cell health, viability, and activation status. It was

determined that the primary microglia grow best in neurobasal media in wells coated with poly-D lysine. Future studies aim to isolate a larger number of cells to allow for co-culture of the inactivated microglia with GBM cells. These results will allow us to better understand the role that microglia play in GBM progression.

353 - Production of a NF-kappaB Deficient Microglial Animal Model

Michael Goodall, Jennifer Bradford

Augusta University, Augusta, GA

Our goal is to determine how the nuclear factor-kappaB (NF-κB) signaling pathway is used in the communication between microglia and the progression of glioblastoma (GBM) cancer cells. The NF-κB signaling pathway is very important in normal immune system function and has been implicated in various types of cancers, including, GBM. GBM is the most common type of adult brain cancer, has altered NF-κB signaling, and is also characterized by a large population of microglia, the immune cell of the central nervous system. Based on our recent studies, we hypothesize that deleting the major transcription factor (p65) of the canonical NF-κB pathway in microglia would slow the progression of GBM. To test this hypothesis, we have developed a $p65^{fl/fl}$/$CX3CR1Cre^{ER}$ transgenic animal, which should lack microglial p65 after exposure to tamoxifen. We currently have heterozygous animals and will soon begin characterizing them to determine p65 deletion efficiency.

354 - The Effects of pH and Bacteria Growth on the Fermentative Digest of *Medicago sativa* (Alfalfa-Grass Hay) in Ruminant Goats

Roberta Rodemann

Emory & Henry College, Emory, VA

Ruminal tympany, commonly referred to as bloat, is a disease in ruminant animals where severe over-distention of the rumen is a result of excessive gas buildup which can result in death. Ruminal tympany is associated with changes in ruminal pH as well as changes in microbial activity during digestion of food. In regard to diet, older pastures are associated with decreased risk of bloat compared to younger pastures; however, explanations for this correlation are inconclusive. Data was collected both *in vitro* and *in vivo* to evaluate the hypothesis that higher cellulose content in hay, often associated with older plant materials, relates to lower bloat. *In vitro* results for differences in bacterial growth and pH shifts were not significant, though more data collection may reveal significance linking hay age with the two variables as a pattern is currently present. I*n vitro* and *in vivo* results were congruent in younger hay yielding significantly more gas than older hay as expected. From *in vitro,* the mean gas produced per minute over the 24 hour period for older hay (0.0046 cc/min) is significantly less than the gas production rate for younger hay (0.0053 cc/min). *In vivo,* the goats yielded the same differences in circumference from the time before and after feeding on both diets of hay, yet the significance was that when feeding on the younger hay, the initial degree of bloat was higher than when the goats were feeding on the older hay. This suggests that the type of diet may have long-term effects on the rate of gas production even prior to feeding. As a result, ruminant animals continuously on younger or lower cellulose diets are at most risk for severe bloat.

356 - EMT and Notch Signaling in FOXI 3 Ablated Prostate cancer cells

Adebimpe Adefolaju, Rashmi Silwal, Pratikshya Joshi

Troy University, Troy, AL

Epithelial-Mesenchymal Transition (EMT) and notch signaling are both biological processes that determine the fate of a cancerous cell as to whether metastasis is in the prognosis of the disease. EMT causes tumor cells to lose their epithelial capacities and overly gain migratory mesenchymal capabilities while recent research shows notch signaling to have effects on the regulation of EMT. Notch signaling on the other hand regulates essential cellular processes of homeostasis and has diverse effects on differentiation, survival, and/or growth of normal cells. In cancer, the aberrant behavior of notch signaling leads to alterations in the normal cell behavior and growth. FOXI3, belonging to FOX family of transcription factors, which is very active during developmental stages becomes inactive in adulthood. In a previous study in our lab, FOXI3, a transcription factor, was seen unnecessarily highly expressed in metastatic prostate cancer cells. Extending this finding, this project will study genes that regulate the EMT and notch signaling pathways to see if this modulation is altered by ablating the FOXI3 gene in prostate cancer cell lines. This will further advance our previous conclusions of FOXI3 and bone metastasis, potentially leading to the development of successful prostate cancer treatments.

357 - Biological activities of extracts from *Rhus michauxii* (Anacardiaceae)

Francisco Garcia

Abraham Baldwin Agricultural College, Tifton, GA

Rhus michauxii (Anacardiaceae) is an endangered species of shrub with a disjunct distribution in Florida, Georgia, North Carolina, South Carolina, and Virginia. *Rhus michauxii* is distinguished from other species in the genus by exhibiting a terminally winged rachis, pubescent leaflets, and highly pubescent stems. Presently, infinitesimal details are available regarding secondary compounds of *R. michauxii*. What is currently known are conflicting reports on the propensity of its toxicity or lack thereof. This research is intended to identify compounds produced by *R. michauxii* and determine if they may be of any medicinal use. An extract was made by grinding leaf material with a mortar and pestle, dissolving the resulting powder in ethanol, and after a period of 72 hours, evaporating the ethanol off using a rotary evaporator. The concentrate was collected with DI water, flash frozen, and lyophilized using a vacuum desiccator with silica beads. High-performance liquid chromatography (HPLC) and infrared (IR) spectroscopy were employed to yield preliminary results on the presence/absence and structure of the compounds of interest. Future research involves secondary compound identification and various bioassays to determine biological activity for *R. michauxii*.

358 - Alternative option for catabolizing equine excreta by *Hermetia illucens* (black soldier fly)

Pedro Escobar

Abraham Baldwin Agricultural College, Tifton, GA

The objective of this research is to determine the capability of *Hermetia illucens*, (Black Soldier Fly Larvae, BSFL), to catabolize organic waste into larval biomass and to ascertain its effectiveness as an excreta waste management alternative. Equine excreta contain large amounts of roughage that needs further breakdown to limit environmental concerns. Our research may provide an alternative solution, with the application of BSFL, microbes and enzymes to break down the cellulose in equine excreta. Every year, large amounts of organic wastes and by-products generate environmental issues, such as greenhouse gases, contamination of water, air, and soil. Waste matter also serves as a reservoir for pathogens and its dispersion. In this study, controlled feeding experiments were conducted. Larvae were fed various diets to compare gains in biomass. An initial trial was performed to determine optimal time to allow the microbes to breakdown the cellulose before feeding it to the larvae. Based on the results, we conclude that BSFL is capable of converting organic wastes into protein-rich biomass, and thus, potentially provide a solution to manure management. In

addition, this research may provide a sustainable method for an alternative feed source and to reduce disease transmission.

359 - Establishing an effective diet to increase growth in the eastern oyster (***Crassostrea virginica***) to aid shoreline restoration efforts

Sharon Blackwell

University of North Georgia, Dahlonega, GA

The eastern oyster (Crassostrea virginica) plays an important ecological role by creating habitat structure via oyster reefs. Overharvesting of oysters in Georgia has led to a decline in abundance and widespread shoreline erosion along estuaries and tidal creeks. Restoration efforts have been established to create a growing population of oysters. In this experiment, we attempted to determine the best diet needed to facilitate rapid oyster growth. Oysters were spawned and cared for following standard procedures of the host hatchery. After one month of care, the oysters were divided into three treatments and moved into downwelling tanks. The oysters were then fed a continuous flow of either: 1) a control diet of incoming filtered seawater, 2) their normal diet of Shellfish Diet 1800®, or 3) a 75%/25% mix of Shellfish Diet 1800® supplemented with Tetraselmis 3600®. For three weeks, the oysters were graded through increasing sieve sizes and removed when they reached a predetermined size. Our results indicate that oysters fed only Shellfish Diet 1800® had significantly greater growth by weight than the control diet and the Tetraselmis 3600® diet. This research will contribute useful information that can be used to further the restoration efforts currently underway in coastal Georgia.

360 - Exploring the Effects of Artificial Sweeteners on Gut-Associated Bacterial Growth and Metabolism

Wyatt Zander, Samantha Miller

Catawba College, Salisbury, NC

The human microbiome is dynamic and unique to every individual. The microbiome of the gut plays an important role in the health of humans and even in the onset of disease states. Many scientists postulate that the diverse species of bacteria that line the large intestine from one individual to the next could explain why some humans develop metabolic diseases such as diabetes and others do not. In addition to individual variations in bacterial diversity, microbiota can be altered by varied diets, for example the consumption of artificial versus natural sweeteners. Therefore, this study sought to investigate the effect of artificial versus natural sugar (sucrose) on the growth of gut-associated bacterial species. Using *Enterobacter aerogenes* as a model organism, we hypothesized that exposure of a prominent gut bacterial species to artificial sweeteners (Aspartame, *Asp-Phe methyl ester* and Stevia, *Rebaudioside A*), would result in growth inhibition compared to a natural sucrose control. Here we discuss our findings, which focused on first addressing the effects of these compounds on overall growth of *E. aerogenes* and other gut-associated bacteria, followed by experiments investigating possible long-term metabolic effects on *E. aerogenes*.

361 - Wild Brew: Barcoding and Culturing Natural Yeast Strains from Rowan County, North Carolina

John Minter, Lee Brackman, Enrique Garcia

Catawba College, Salisbury, NC

Wild yeast fermentation to create a variety of beers is an ancient brewers' technique that has recently resurged in breweries world-wide. The goal of our project was to isolate and

characterize wild yeast isolates, specifically *Saccharomyces* species, from acorns in Rowan County for future use in beer varieties of New Sarum Brewery in Salisbury, North Carolina. We hypothesized that wild yeast strains capable of fermenting malt extracts with favorable aromatics could be isolated using the current protocol (Garcia et. al., 2017, unpublished), and further purified to create in-house isolates for long-term propagation. We mashed the acorns and placed them into sterile jars filled with yeast nutrient extract. After a 2-week fermentation period, samples were transferred to sterile yeast nutrient agar plates and passaged several times to ensure axenic yeast culture. Cultures were established with isolated yeast strains to determine fermentation capacity of malt while simultaneously subjecting isolates to DNA barcoding analysis (ITS1-5.8S rDNA-ITS2) as described (Masoud et al., 2004).

362 - Fibroblast Growth Factors and Bone Remodeling in FOXI3 Ablated Prostate Cancer Cells

Jason Hall, Rashmi Silwal, Pratikshya Joshi

Troy University, Troy, AL

Cancer research has been at the forefront of scientific research for over 30 years and still holds that position today, for numerous cancer types have been discovered; most to be considered lethal with significant progression. Specifically, our research focuses on prostate cancer, using genetic and molecular approaches to observe metastatic rates into the bone. Studies have shown that metastasis is the chief cause of death for patients with prostate cancer. Regarding metastasis, FOXI3 is a previously discovered transcription factor found throughout the body that plays a large role in embryogenesis and bone formation. FOXI3 expression is reduced in adult cells; however, our lab observed increased levels in prostate cancer cells. Because growth is not entirely halted when silencing the FOXI3 gene, additional proteins and growth factors may be involved in cancer progression within the bone. This project will further investigate the gene expression of FGFR receptor proteins involved with the binding of Fibroblast Growth Factors (FGF), as well as the investigation of some genes that may be modulated in bone metastasis as a result of FOXI3. Particularly, SPRY1 is a gene associated with the inhibition of the FGF pathway, while RANKL, BMP2, and SPP1 are all genes associated with bone remodeling that could be used to counter the effects and damage caused by prostate cancer. This will further advance our previous conclusions of FOXI3 and bone metastasis, potentially leading to the development of successful prostate cancer treatments.

363 - Detection of Bacterial Contamination in Blenderized Food for Tube Feeding in a US Hospital Setting

Lasata Shrestha

Troy University, Troy, AL

A gastrostomy is a surgical procedure used to insert a tube through the abdomen and into the stomach. This allows the patients to be fed directly into their stomach. Blenderized food was initially used for gastrostomy feeding, which was then replaced by commercial formula feeding. It still remains controversial which feeding is best for the patients, especially in terms of nutrition and microbial contamination. In this research, we plan to detect and identify bacteria present in blenderized food and commercial formulas under safe food handling and tube feeding delivery standards followed in U.S. hospitals. Professors in Troy University will work together to perform this research and my lab is responsible to detect and identify bacteria in food samples by molecular-based techniques. The results of our research can help establish safety regulations in preparing and handling these food products.

364 - Effects of Sublethal Exposure to Glyphosate on Swimming and Feeding Behavior in Killifish, *Fundulus heteroclitus*

John Baxter, Timothy Hernandez

University of North Georgia, Dahlonega, GA

Killifish, Fundulus heteroclitus, are found in tidal creeks along the Georgia coast. Living in the intertidal zone, they are able to cope with drastic temperature and salinity changes. Killifish are central to the food web in salt marshes, which makes them ideal candidates for testing the effects of toxicants found in their environment. In this study, we studied glyphosate, the active ingredient in the herbicide RoundupTM, which has neurotoxic effects on fish behavior. Killifish were exposed to sublethal concentrations of Roundup for 24 hours. Control fish were held in clean seawater. Before and after toxicant exposure, killifish were placed in a T-shaped maze and allotted 10 minutes to find and consume food that was placed at one of the arms. General swimming behavior and time to consume food were recorded. Muscle glyphosate concentration was quantified by ELISA. Roundup caused significantly impaired killifish feeding, with most exposed fish failing to find food, and abnormal swimming behavior, such as erratic swimming, as compared to unexposed fish. Likewise, fish showed a general positive correlation between increasing glyphosate exposure and tissue concentrations. These results indicate that glyphosate adversely affects swimming and feeding behavior, which impedes their ability to survive in an already stressful environment.

366 - Cancer-related single nucleotide variations within microRNA-34a-binding sites.

Emily Wiggins[1], S.C. Hushner[2], A Budmark[2], T. Wagner[2], T. Haley[2]

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MicroRNAs are small non-coding RNA molecules that regulate gene expression. They bind to their mRNAs target sites, resulting in gene silencing through mRNA degradation and / or translational repression. miR-34a, a member of the miR-34 family, is downregulated in many cancers, and its levels often correlate with patient's survival and prognosis. Deregulation of miR-34a is linked to the resistance of tumors to chemotherapy. It has been suggested that naturally occurring single nucleotide variations (SNV) in microRNA-encoding genes, as well as polymorphisms within or nearby miRNA-binding sites on genes-targets, may enhance or weaken the interaction between miRNA and its target transcripts and contribute to phenotypic variations and disease susceptibility. In order to compile the data about SNP within microRNA-34a encoding gene and microRNA-34a target sites we reviewed the following databases: PolymiRTS (http://combio.uthsc.edu/miRSNP/), Snpeffect (http://snpeffect.vib.be), dbSMR (https://bmcbioinformatics.biomedcentral.com/articles/10.1186/1471-2105-10-108), SNP effects of transcriptional regulation (http://cbrc.kaust.edu.sa/dpore), miRdSNP (http://mirdsnp.ccr.buffalo.edu), SNPedia (http://www.snpedia.com/index.php/SNPedia), miR-related SNP (http://www.bioguo.org/miRNASNP/) and NCBI. We found that single SNP were present in 31% of microRN-34as seed matching areas, and two and more SNPs in9% of microRNA-34a seed matching sites. We conclude that combinations of favorable and unfavorable SNP may render microRNA-34a hyper-functional or, in opposite, completely disable it, thus resulting in significant phenotypic variations and predisposition to cancers.

367 - A Survey of Amphibians in an Urban Northwest Georgia Wetland Before and During Restoration

Morgan Harrison[1], Melissa Pell[2], Carrie Swinney[2]

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One of the goals of habitat restoration is to create more favorable conditions for wildlife, which may then lead to increases in species richness and abundance. However, during the process of restoration, disturbance to habitats often occurs, potentially leading to temporary negative effects on wildlife. The objective of our study was to survey the amphibian community in a wetland before (2016) and during (2017) the restoration of this area in order to assess the effect of the restoration process on this community. The 0.7 ha wetland is located within Lakeshore Park, a public park in Dalton, GA. Restoration activities included drops in water levels within the wetland and adjacent 1 ha lake, grading of the lake banks, and removal of construction debris from the wetland edge. Trapping methods consisted of drift fences with pitfall traps, PVC tubes, and coverboards deployed in areas near the wetland edge. Traps were checked daily and environmental conditions were noted at the time of capture. Animals were identified, measured, and released.In each year, Hyla cinerea and Lithobates clamitans were the most abundant species collected. In conclusion, we have observed no substantial effect of restoration activities on the amphibian community.

368 - Understanding the Mechanistic Role of Integrin Alpha 6 in Tumor Development Using a Humanized Zebrafish Model System

Ashley Williams, Reid Loveless, Shauntell Luke, Louise Zehr

Georgia Southern University, Statesboro, GA

Present day cancer incidence and mortality rates indicate the need for effective cancer diagnostic tools and targeted cancer therapeutic strategies. Recent studies have focused on the biological pathways of cells and tumor microenvironments to identify putative biomarkers and potential drug targets as diagnostic and therapeutic tools. Human integrins, adhesion receptors, have become the focal points in these studies, specifically Integrin Alpha 6 (ITGA6) which has been implicated in major tumor progression roles: metastasis and angiogenesis. These characteristics make ITGA6 an excellent candidate for potential drug or diagnostic target, however, the mechanism by which ITGA6 facilitates tumor progression remains unclear. Cell culture studies have indicated ITGA6 could be cleaved extracellularly to increase metastasis but, zebrafish with organismal structures and vascular network, present a complete in vivo model to track metastasis. In this study, we aim to identify the role of ITGA6 in tumor development by using a humanized zebrafish model, where CM-DiI labeled human breast cancer cells (MDA-MB-231) are transplanted into Tg (Fli1a: gfp) embryos that are overexpressed with human ITGA6 constructs. To test the domain specific role of ITGA6, human full-length or truncated extracellular or mutated non-cleavable ITGA6 RNA is injected into the zebrafish tumor xenograft. Our studies indicate that truncated ITGA6 overexpression significantly upregulates tumor metastasis compared to full-length ITGA6 overexpression. Similarly, mutated ITGA6 significantly decreases tumor metastasis. These results suggest that cleaved ITGA6 increases tumor metastasis, potentially aiding in extracellular matrix remodeling. The cellular role of ITGA6 will be evaluated by transplanting ITGA6 siRNA and DNA transfected MDA-MB-231 cells into zebrafish tumor xenografts. We anticipate these experiments will help establish the cell and non-cell autonomous roles of ITGA6 during tumor development. Further, we expect to use high-resolution imaging techniques to track the migration of single cancer cells in an in vivo system to understand the dynamics of metastasis.

369 - Surveillance of mosquitoes in Bulloch Co. Georgia for canine heartworm in canine positive locations

Angelica Tumminello

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Canine heartworm disease is caused by the filarial nematode, Dirofilaria immitis. The nematode is transmitted by at least 25 known species of mosquito vector. We seek to

understand which species of mosquitoes are transmitting canine heartworm disease in Bulloch County, Georgia. Surveillance for heartworm-positive mosquito vectors was conducted in known heartworm-positive canine locations: Bulloch County Animal Shelter, Mill Creek Park, and Azalea Drive. Gravid traps were set adjacent to each location with fermented hay, water, and chicken manure as bait. This method was implemented so that samples gathered would contain a majority of gravid female mosquitoes as opposed to a method like light trapping, which often also draws many beneficial and non-targeted insects. Vacuum trapping was also occasionally implemented in cold weather months, when mosquito activity is low. Traps were set in the evening and picked up in the morning to be returned to the lab. Mosquito samples were frozen until deemed inactive, then identified by species and sex. The mosquitoes were then dissected in 0.8% physiological saline under a compound microscope at a total of 400x magnification. Examination of the Malpighian tubules for larvae was done first, followed by the examination of the rest of the abdomen and thorax. Species, sex, date collected, trap type, feeding status, and heartworm presence were recorded for each specimen in the lab. One possible heartworm larvae was identified during the course of this study in an Aedes atlanticus mosquito from the animal shelter site. This is a possible indicator that a heartworm-positive animal was housed there. For future studies, we can increase the sample size by expanding the number of traps set at each site as well as the number of heartworm-positive locations we survey to conduct a more comprehensive study. We also have plans to run polymerase chain reaction with a primer specific to Dirofilaria immitis. This will eliminate possible human error of missing the larva during dissection as well as allow us to analyze batches of mosquitoes instead of one at a time.

370 - Developing High-Throughout Sensory Behavioral Assays for Zebrafish Larvae.

Shannon Wagner

Georgia Southern University, Statesboro, GA

371 - A survey of plant genome sizes in the Fred Stanback Jr. Ecological Preserve located in the piedmont of North Carolina

Belony Joseph

Catawba College, Salisbury, NC

The C-value is a standard measure of plant genome size used in plant taxonomy and other biological fields. The C-value is the amount of nuclear DNA in a haploid genome and is calculated in picograms per cell. The C-value paradox is the expectation that the complexity of plants (and other organisms) would be proportional to their genome size, but C-values varies greatly among plant species. In this study we used flow cytometry to measure C-values of various plants collected from the Fred Stanback Jr. Ecological Preserve, in the piedmont of North Carolina. We collected C-values for each plant in triplicate and compared them to their published C-values, if available. We studied numerous plants including, *Aplectrum hyemale, Pinus strobus, Pinus virginiana, Tipularia discolor*, and *Trillium cuneatum* using two different tissue chopping buffers. These data, including several C-value estimates new to science, will allow future researchers to investigate potential cryptic species and study interesting intraspecific gradients in C-value.

373 - Identification of UNC-119, a SRC Kinase Activator, in Sea Star Eggs

Jamie Kitson

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The key molecular factors controlling fertilization are not well understood in any species. In the starfish model system, it has been established that Src family kinases are essential to the

activation of Phospholipase C gamma, which leads to Ca^{2+} release at fertilization. However, the upstream regulators of these Src kinases within the egg are not yet known. To identify potential Src activators in starfish eggs, a bioinformatic analysis of the newly available *Patiria miniata* transcriptome was performed. Using the NCBI (National Center for Biotechnology Information) TBLASTN software, protein sequences similar to a Src activating protein from humans, Uncoordinated 119 (UNC-119), were found in the starfish transcriptome. To confirm the presence of UNC-119 in starfish, reverse transcription PCR (RT-PCR) was performed on mRNA isolated from starfish eggs and the PCR product is currently being sequenced. Once the sequence of the starfish UNC-119 mRNA is confirmed, clones will be produced of this protein and used in experiments to investigate its role at fertilization.

374 - Lyme Disease in the Eastern United States: Comparative Host-Parasite-Pathogen Phylogeography

Amanda Whitlow

Emory & Henry College, Emory, VA

This study seeks to elucidate post-glacial comparative host, parasite, pathogen phylogeography for Lyme Disease in the eastern United States. Ixodes scapularis populations originated in the southeastern United States, rapidly expanding into the Northeast and Midwest after recession of the Pleistocene (Wisconsinan) ice sheet 20,000 YBP. Two known reservoir hosts for Borrelia burgdorferi exist in the east: Peromyscus leucopus and Odocoileus virginianus. Congruence of phylogeographic/phylogenetic patterns among all component species (host, vector, and pathogen) would support the hypothesis of persistence and northward postglacial dispersal from the same glacial refugium at the end of the last ice age. Investigation of the phylogeographic relationships among component species of Lyme disease will help uncover the relationship between climate change and emerging infectious diseases. Field collection of black-legged ticks along the I-81 corridor from Tennessee to Maryland was conducted during the summer of 2017. Specimens were collected through two different techniques known as flagging and dragging from 20 localities. Total number of ticks collected to date is approximately 120. Further collection of ticks will occur throughout the spring and fall to expand the range of sampling from Maryland to Pennsylvania. Mitochondrial DNA sequence data from the control region (D-loop) was analysed from 30 specimens of Peromyscus leucopus to determine phylogeographic structure of the species across its range in North America. Four major clades were identified (Eastern, North-Central, Southwestern, and Northwestern) indicating up to four Pleistocene glacial refugia that served as sources for post-glacial dispersal of this reservoir species for Borrelia burgdorferi. Tick identification will be confirmed using a “cocktail” of 16S (DvF2) internal primers. Analysis of the D-loop and cytochrome B regions of Ixodes scapularis and Odocoileus virginianus is on-going. Sequence analysis of the Lyme spirochete, Borrelia burgdorferi will heavily rely upon whether or not ticks were infected prior to collection.

375 - Cortical Brain Organoids Model the Development of Autism Pathology

Pranaya Pakala

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Autism is a genetically complex neurodevelopmental disorder in which patients exhibit social deficits in both verbal and non-verbal forms of communication and display restricted and repetitive behaviors. Emerging evidence suggests that altered neural connectivity, particularly at the level of synaptic connections, contributes to disease pathology. In idiopathic autism cases, postmortem patient brain samples exhibit increased numbers of excitatory synaptic connections in cortical brain regions that govern social behavior (PMID: 21346746). However, the use of post-mortem brain samples prevents researchers from capturing the development of

this altered brain circuitry. Thus, we set out to develop a physiologically relevant model of idiopathic Autism that recapitulates defective neuronal circuitry at the level of both neurite and synapse formation. We began by reprogramming Autism patient fibroblasts into human induced pluripotent stem cells (hIPSCs), which we subsequently differentiated into 3-D cerebral organoids ('mini-brains') using a low-attachment protocol (PMID: 26005811). Similar to the in vivo cerebral cortex, these 'minibrains' contain diverse brain cells, including neural progenitor cells, both excitatory and inhibitory neurons, and supporting glial cells. Additionally, brain ventricles develop. However, in Autism hIPSC-derived mini-brains, we observe dramatic differences in 'mini-brain' organization. In neurotypic controls, neurons develop around brain ventricles and their neurites associate with one another to form a patterned organization within cortical layers. By contrast, Autism-derived 'mini-brains' have negligible ventricle formation and their neurites form a disorganized meshwork throughout the organoid. Furthermore, Autism-derived 'mini- brains' exhibit increased levels of excitatory synapse formation. Thus, we describe a model that recapitulates the development of altered brain circuitry associated with idiopathic Autism. Importantly, this model will enable us and other researchers to dissect out the molecular mechanisms contributing to Autism pathology and to test whether specific pharmacologic intervention can rescue altered neurite and synapse formation associated with Autism.

377 - A Shell Geometry Ratio Model for Inferring Habitats of Extinct and Extant Testudines'.

Benjamin Sexton, George Argyros

Emory and Henry College, Emory, VA

Adaptation of the shell allows turtles to occupy a wide variety of habitats, both aquatic and terrestrial. Comparing shape and size of these structures across different species of turtles can give a generalized idea and basic understanding of how a turtle's environment affects the morphology of the species. In our study, we took a series of 4 measurements (length and width of carapace and plastron, and total height of the shell) from 76 specimens representing 13 species of Virginia turtles, from the Virginia Museum of Natural History. Two different ratios were calculated. The first (Ratio 1), comparing carapace length and width against total height and plastron width; the second (Ratio 2) being carapace length and total height against the width of both the carapace and plastron. We then used the ratios to conduct a regression plotting Ratio 1 against Ratio 2 to determine if specimen points cluster by species and shell geometry correlated to habitat preferences of each species By utilizing ratios of length, width, and height of the carapace and plastron, we hypothesize that greater length and width to height ratios are correlated with more aquatic habitats, and that these ratios can be used to infer extinct species habitat preferences where lithological data are inconclusive, or lacking. Data analyzed to date indicates moderate correlation of shell geometry to habitat type. However, due to small sample size, and variation due to age-related shell proportions (i.e., juvenile skewing), results are somewhat inconclusive for certain species.

378 - The Diversity, Abundance, and Sensitivity of Soil Microbes to Chromium after the Dan River Coal Ash Spill

Brittany Johnson, Anna Price, Haley Shaffer, Fasth Lauren, Rachel Smith, Shalondra Brown, Rabina Mainali, Aryatara Shakya, Nicole Keyser, Chandler Robinson, Dane Kuppinger, Laura Watts

Salem College, Winston-Salem, NC

In 2014, 50,000 tons of coal ash were released into the Dan River near Eden, North Carolina. Elemental analyses of coal ash have revealed it frequently contains numerous heavy metals and pollutants, including Chromium, a known mutagen. One year following the spill, research was conducted to determine if soil samples taken along the bank of the Dan River exhibited

either abiotic or biotic differences when compared to upstream reference samples. That study demonstrated that not only were concentrations of Chromium considerably elevated in certain areas downstream of the spill, but soil microbes taken from coal ash exposed locations had significant differences in their density, diversity, and enzymatic activity. Herein, we followed up on that study by addressing the impact of Chromium exposure on the viability of common soil microbes and the density/Chromium resistance of bacteria from coal ash exposed samples taken from the bank of the Dan River. This study found that common soil bacteria exhibit unique sensitivities to Chromium. Furthermore, bacteria from soil taken at the spill site also exhibited an increased tolerance to Chromium at certain concentrations as compared to bacteria sampled up and downstream of the spill.

379 - Effect of pickling on the morphology of ***Cucumis Sativus***

Daniel Kim, Elizabeth Klar, Julie Ballenger

Columbus State University, Columbus, GA

Pickling foods is one of the oldest, cross cultural culinary techniques used for food preservation. Most pickles are produced using lacto-fermentation or vinegar. This study will investigate the effect of pickling on cucumbers from various cultivars. The pickling treatment that will be performed on the cucumbers will be the pickling technique trademarked by the Real Dill Pickles, a company based out of Columbus, GA. In this study, the tissues of cucumbers and pickles will be examined using glycol methacrylate embedding with the addition of polyethylene glycol 400 which allowed sections to be cut using a microtome equipped with steel blades. The study found that the average length and maximal width of the cucumbers used by the Real Dill Pickles Company differed from other cultivars. Preliminary examination of sections showed that the outermost layer of cells of the cucumbers used by the Real Dill Pickles were thinner, cuboidal-shaped as opposed to other cultivars. Histological data will elucidate any changes in morphology of the epidermal and parenchyma cells due to pickling method.

380 - "Systematics and Taxonomic Status of *Peromyscus leucopus* ammodytes"

Taylor Richardson

Emory & Henry College, Marion, VA

A comparative morphometric study was conducted to evaluate current taxonomic status of four subspecies of White-footed Mice (*Peromyscus leucopus*) occurring in northeastern North America: *P. l. noveboracensis, P. l. caudatus, P. l. fusus, and P. l ammodytes.* A total of 31 external and cranial linear measurements were used to assess non-geographic and geographic variation of 246 individuals representing the four subspecies. Subsets of populations were sampled from localities in Nova Scotia, coastal mainland (New Hampshire to North Carolina), and the islands of southern New England (Monomoy, Martha's Vineyard, Nantucket, and Block Island). Results of non-geographic variation of *P. l. ammodytes* occurring on Monomoy Island are presented. Non-geographic variation (differences based on sex and age) was analyzed for each subspecies. Due to insufficient sample sizes representing all adult age categories (4/5/6), ANOVAs assessing variation in age for the Monomoy subspecies were not conducted. Variation between the sexes was conducted on 88 individuals of Adult Age Category 4 of *P.l. ammodytes*. Of the 31 measurements analyzed, none were statistically different. For mainland populations studied for non-geographic variation, ANOVAs indicated no statistical difference among the three adult age categories. Only 3 of 31 measurements showed significant statistical differences between the sexes: Basilar length, Condyloincisive Length, and Zygomatic Breadth. As a result, male and female adults of all three age categories will be combined for interpopulational (i.e., Georgraphic) comparisons. Future goals of this study include analysis of geographic variation using multivariate PCA, and mtDNA analysis of

these northeastern subspecies to further assess the degree of phenotypic differentiation of *P. l. ammodytes.*

381 - Relative Abundance of Benthic Invertebrates in Pacific Panama

Tori Hawkins

Florida Institute of Technology, Melbourne, FL

The Gulf of Panama experiences seasonal, wind-driven upwelling, which increases planktonic productivity and, therefore, could increase the growth of suspension-feeding invertebrates. The Gulf of Chiriqui does not experience upwelling. The purpose of this study was to examine the effects of upwelling on the relative abundance of invertebrates and algae. The results show a trend of higher relative abundance of suspension-feeding invertebrates where upwelling occurs. This furthers our understanding of the ecosystem and allows us to understand population changes over time.

382 - From Trash to Treasure: Techniques for Reconstructing Mitochondrial Genomes from Highly Fragmented Historical DNA

John Hetzel[1,2], John Hanson[1]

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As the importance and prevalence of genomics grow, so do the number of tools for obtaining, refining, assembling, and interpreting genetic data. With the wide variety of programs available, there is a need for the development of well-tested pipelines that join these tools together to carry raw data to a finished product. In particular, the *de novo* assembly and analysis of repeat-dense mitochondrial genomes for non-model organisms without references continues to be problematic for researchers working with rare species that have few sampled specimens. To address this issue, we aim to test and compare two different iterative-mapping software packages (MITObim and GRAbB) using mitochondrial and ultra-conserved element (UCE) sequence data derived from historical samples of tissue and skin obtained from rodents in the family Sigmodontinae (Rodentia, Cricetidae). By benchmarking the effectiveness of these tools using metrics, such as wall time, contig number, and read length, we can develop a best-practice guide for future assemblies.

383 - Fire History of the Peruvian Andes

Madeleine Bitting

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Human activity has considerably altered global landscapes for thousands of years. Modern technology can be used to understand these impacts and benefit efforts to reduce further environmental damage done by modern-day societies. In this study, charcoal analysis was used to investigate the effects of early human civilizations and climate on fire activity in the Andes mountains and to determine if low-resolution core sampling can yield data of similar accuracy to high-resolution sampling. In 2010, a research group from Florida Institute of Technology extracted a 1.8 m long sediment core from the deepest point (60 m) of Laguna de los Condores located on the Eastern flank of the Peruvian Andes at 2860 m elevation (Matthews-Bird et al. 2017). This group produced an age-depth model to establish core chronology using C14 dating of sediment samples from various depths, dating it to approximately 2050 cal. yr BP (Matthews-Bird et al. 2017). This model was also used in this study to produce a charcoal chronology consistent with the other limnological data collected from this core. Core sediments were sampled continuously at 1 cm resolution by depth and rinsed with water through a 160 µm mesh to filter out fine particulate and organic material. Charcoal particles were separated and photographed under an Olympus Stereoscope at 20x

magnification and the total area of charcoal was measured using ImageJ (Schneider et al. 2012) for each of the 185 samples. Charcoal peak analysis was performed using CharAnalysis v. 8.3 (Higuera et al. 2009) in MATLAB to produce a timeline of fire intensity and frequency. Charcoal peaks were compared to local ice core (Bird et al. 2011), limnological (Matthews-Bird et al. 2017), and archeological (Wild et al. 2007) records to draw conclusions about the effects of humans and climate on fire regime in the tropical Andes. Decreasing trends in fire frequency and intensity were observed during periods where archeological and limnological records suggest a transition from agricultural to ceremonial land use deduced from reduced terrigenous input and nutrient loading in the lake and radiocarbon dates of mummies from a nearby burial ground (Matthews-Bird et al. 2017; Wild et al. 2007). Changes in fire frequency and intensity were not closely aligned with changes in precipitation indicated by an ice core dO18 record (Bird et al. 2011). Different sampling resolutions were interpolated and compared in R (R Development Team 2008), revealing that continuous and 3 cm resolution sampling yielded more precise records than lower (5 cm) resolution sampling of Lake Condores.

384 - Characterization of Soil Microbial Fitness in Coal Ash Exposed Soil Samples

Nicole Keyser, Brittany Johnson, Chandler Robinson, Anna Price, Haley Shaffer, Lauren Fasth, Rachel Smith, Shalondra Brown, Rabina Mainali, Aryatara Shakya, Dane Kuppinger, Laura Watts

Salem College, Winston-Salem, NC

In 2014, 50,000 tons of coal ash were spilled into the Dan River of North Carolina. Coal ash is known to contain many chemicals that can pose a threat to soil ecosystems, including the heavy metal chromium, which can have deleterious impacts on soil microbes. One year following the spill, chemical analyses of soil taken from the river bank found that chromium levels remained elevated at some downstream locations. Additionally, soil microbial populations were found to exhibit significant differences in the concentration, fitness, and identity of soil microbes when compared to upstream reference samples. This study assessed whether the trends observed in previous analyses remained approximately four years after the spill. Herein we report that while the total microbial density and diversity of culturable bacterial in coal ash exposed soils was still significantly altered when compared to control samples, the concentration of culturable bacteria appears to have normalized.

385 - Impact of the Dan River coal ash spill on soil abiotic factors

Mallorie Iozzo, Jemima Piloso, Catherine Elbakidze, Laura Watts, Dane Kuppinger

Salem College, Winston-Salem, NC

In 2014, 50,000 tons of coal ash from Duke Power's Dan River Steam Station were spilled into the Dan River near Eden, NC. Coal ash contains a variety of toxins including heavy metals including Chromium. This study investigates the potential effects of the coal ash on soil microbes, including the potential effect of known heavy metal component hexavalent Chromium. Because of the essential role of microbes in the biogeochemical cycling of nutrients including Nitrogen, impacts to this community could have dramatic effects on ecosystem dynamics. To assess the activity level of soil microbes involved in the Nitrogen cycle, samples were collected up and downstream of the spill as well as at the spill site. Nitrite, Nitrate, Ammonia, and Ammonium concentrations were assessed at the time of collection and after incubation in both aerobic and anaerobic conditions. Some of the Initial concentrations of Nitrogen compounds were found to be significantly different in between upstream, downstream, and spill site locations, and these significant differences persisted following incubation under aerobic and anaerobic conditions. These differences in the concentration of different forms of Nitrogen may be associated with changes in the population size or composition of the microbe community. Chromium concentrations were found to be lower than those determined to have biological significance.

Beta Beta Beta Abstracts

2478 - **Identifying and examining potential bacterial pathogens in a rural, Alabama primary elementary school**

Jason Floyd

University of North Alabama, Florence, AL

It is well known that bacteria contribute to the onset of illnesses among young children in the public education system through interpersonal contact among students. However, another likely cause of rapid disease transmission is poor air ventilation and filtration, which decreases a building's indoor air quality (IAQ). The goals of this Sick Building Syndrome (SBS) study are: 1) collect air samples from a rural, Alabama primary elementary school (School P), 2) identify which bacteria are present in the air samples, 3) determine the relative number of bacteria per cubic meter in School P, and 4) assess the antibiotic resistance of the identified bacteria. Air samples will be collected and bacterial cultures will be grown on either bacterial specific media. Once cultures have been isolated they will be identified using the Biolog GEN III Microbial Identification System. A formula for colony forming units per cubic meter (CFU) will be used to assess the number of microbes collected within School P. Antibiotic resistance will be tested with each microorganism identified using a Kirby-Bauer antibiotic susceptibilityprotocol. Results obtained from the study will help School P improve its indoor air quality (IAQ).

2482 - **Baseline biodiversity of the terrestrial and aquatic biota in an undisturbed hardwood forest slated for road construction.**

Emily Rabjohns, Levi Thomas, Sarah Edmonds

William Peace University, Raleigh, NC

Our research site comprises a patch of old hardwood forest in Wake Forest, NC with a small second order stream. The unnamed tributary runs into Smith Creek, which drains into the Neuse River. Road construction is planned to transect the property in 2018, which provides a unique opportunity to determine the impact of construction on this site. We surveyed the creek and adjacent land 100 meters on either side to survey the biodiversity of macroinvertebrates, fish, amphibians and reptile populations. We also tested the water for oxygen, pH, nitrates, phosphates, chlorine, and ammonia-nitrogen. Although water chemistry analyses yielded normal ranges for the Central Piedmont region, the macroinvertebrate diversity was lower than expected. Notable siltation from residential construction nearby may have affected the biota. Dominant species were pollution-tolerant caddisflies, mayflies and dipterans. The most common invertebrate species was the crayfish, *Cambarus latimanus.* Fish populations were dominated by creek chubs (*Semotilus atromaculatus*) and rosyside dace (*Clinostomus funduloides*). *Semotilus* are highly adaptable and tolerant of silt and pollution. We expect this species to endure change from construction fairly well. *Clinostomus* is a sensitive species that is intolerant of turbidity and silt and typically thrives in clear, cool water in forested areas, so deforestation and siltation from construction should adversely affect their population. Amphibian and reptile species were fairly abundant despite the running and mountain bike trails that have fragmented the site and reduced organismal movement. Given the extensive recreational use, the number and diversity of amphibian and reptile species were good. These data will serve as a baseline to determine the impact of road construction on the biodiversity of the site, which we plan to monitor throughout the construction and for at least a year after completion to determine the long- term effects on the residential populations.

2483 - **The Effects of Nicotine on the Expression of *CHRNA3* in Correlation to Chronic Obstructive Pulmonary Disease**

Kaitlynn Stowers, Dr. Christine Fleet

Emory & Henry College, Emory, VA

Researchers are studying whether there is correlation between gene expression and the development of Chronic Obstructive Pulmonary Disease (COPD). Understanding gene expression patterns in the gene CHRNA3 (Cholinergic Receptor Nicotinic Alpha 3) has been on the forefront of developing a deeper awareness of leading risks factors for COPD. This study uses NIH/3T3 Mus musculus cells exposed to nicotine concentrations over varying time lengths to develop a better understanding of the genetic impact of nicotine exposure. Nicotinic concentrations of 1µM, 10µM, 25µM, and 50µM were administered to cells for up to 48 hours. qPCR was used to identify CHRNA3 expression in treated versus untreated cells. Results indicated that at a concentration level of 10µM, CHRNA3 expression was upregulated. Since this gene has been associated with COPD development, my data suggests a correlation between nicotine exposure altering CHRNA3 expression, which could contribute to the onset of COPD.

2487 - **The effect of disturbance on vegetative community structure and diversity: A comparative survey**

Ashley Desensi

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Disturbances, human or natural, are known to have adverse effects on community diversity and stability. In order to assess the effects of disturbance (and other possible factors which contribute to the health of an area), researchers use ecological surveys. These surveys provide important information about the overall health of a community. This study proposes to characterize the flora of two predominantly hardwood forests located in Harris County, Georgia. The study sites were selected based on their close proximity, and vast differences in community structure. The collected data was analyzed and assessed to provide a full picture of the conditions of each habitat. Results revealed variations in relative abundance of selected species and differences in overall community structure between the two sites. Tree species diversity and age distributions also varied greatly between sites.

2501 - **Novel etoposide analogs inhibit the growth of cancer cells in culture**

Priyanka Kumar[1], Amber Bradley[2], Joe Deweese[2], Chris Barton[1]

[1]Belmont University, Nashville, TN, [2]Lipscomb University, Nashville, TN

2506 - **Characterization of a novel mouse model to study IL-3 expression**

Chandler Parker

Bridgewater College, Bridgewater, VA

Malaria is caused by a protozoan parasite. Previous studies in our laboratory using a murine model of malaria have indicated that malaria-infected mice lacking the protein interleukin-3 (IL-3) (KO mice) survive better than malaria-infected mice with the IL-3 protein (WT mice). Furthermore, IL-3 KO mice produce less of the inflammatory cytokine interferon-gamma (IFN-g) early during infection than the WT mice. This would indicate that IL-3 is either directly or indirectly regulating IFN-g expression. In order to determine the role of IL-3 in malaria pathogenesis, we developed a novel mouse model using CRISPR technology. In this mouse whenever the IL-3 gene is expressed, a ZSGreen fluorescent protein gene is expressed as well. Therefore, we can use this mouse to determine which cell types are secreting IL-3 using

fluorescent technology such as flow cytometry or immunofluorescence. This talk will focus on data characterizing this new mouse model.

2508 - **Structure-to-function relationships of iron- and manganese-lipoxygenases**

Claire Fabian-Bayola

East Carolina University, Greenville, NC

Lipoxygenases (LOXs) are enzymes that catalyze the (per) oxidation of unsaturated fatty acids. They serve as the beginning of cellular signaling steps that cause inflammatory responses by the production of leuktrienes and lipotoxins, both of which can attribute to the development of asthma, cancer, and arthritis in humans. To initiate the necessary biochemical reactions, lipoxygenases possess an iron center (SLO) but organisms in the Fungi kingdom use manganese (Mn-LOX). It has been found that Mn-LOX can interchange iron and manganese to their needs, but SLO that is found in plants and humans cannot. So far, when substituting manganese into natural SLO's, there has been no functionality. This is possibly due to the differences in redox potentials. Through site mutagenesis, residues at the active site and first (and second) shell ligands are being replaced or deleted to determine their effect on enzyme activity. If the iron substituted into native Mn-LOX produces a functional enzyme, kinetics will be measured through electropotential probes and samples will be prepared for structural analysis using X-ray crystallography. This could be a stepping stone to the expansion of biomedical technology and a better understanding in inflammatory responses in humans.

2512 - **Forensic Anthropology**

Michaela Mays

Gardner-Webb University, Boiling Springs, NC

Forensic anthropology techniques are reviewed and examined for accuracy in crime scene investigation cases. There are many techniques used to investigate a crime scene. These include sex estimation, age estimation, wound trauma, among others. Peer reviewed articles were used to determine the accuracy of these methods. Primary focus was on technique that applied different sections of the body to improve likelihood of identification in a crime scene. All seven reviewed papers reported accurate methods for unknown identification of victim's characteristics and causes of death.

2525 - **Modeling the Effects of *Diadema mexicanum* on Benthic Components of Eastern Pacific Coral Reefs**

Victor Rodriguez-Ruano

Florida Institute of Technology, Melbourne, FL

Sea urchins of the Diadematidae family have been known for affecting coral reef dynamics such as carbonate balance and macroalgal cover due to their grazing activity. The main objective of this study was to develop statistical models that could describe the response of macroalgae and coral cover to the grazing activity of *Diadema mexicanum* in the Eastern Tropical Pacific (ETP). The study was conducted on the Pacific coast of Panamá, 3 sites were sampled in the Gulf of Chiriquí and 3 others in the Gulf of Panamá using video transects. The relationships between *Diadema mexicanum*, macroalgae cover and coral cover were determined by developing 2 generalized linear models, one for each benthic component. The macroalgae model determined that *D. mexicanum* had a significant negative effect on macroalgae cover while the coral model failed to provide enough evidence for a positive relationship. The model was further tested with data from the Mexican Caribbean, yet if failed to make accurate predictions on the response of macroalgea cover to *Diadema antillarum*

density. It was concluded that *D. mexicanum* is likely to play a key role controlling macroalgae population growth, yet the coral relationship might be more influenced by environmental factors such as climate change and El Niño events.

2526 - **Investigating the housekeepers of the cell: Molecular chaperones at fertilization**

Altair Dube

Florida Institute of Technology, Melbourne, FL

Proteostasis is a vital component to regulating normal cellular physiology. Molecular chaperones are important in maintaining homeostatic conditions through ensuring proper folding of proteins. We are investigating the changes in protein expression of these molecular chaperones during fertilization, using the starfish *Patiria miniata* as a model system. Although the relative roles of molecular chaperones are well studied in response pathways such as response to stress, roles of chaperones are not well understood during fertilization and early development. The fertilized zygote displays increased metabolism and increased protein synthesis. In this study, the class of molecular chaperones known as heat shock proteins (HSP) were identified and characterized. HSP70 and HSP90 polypeptides, transcripts, and genes were found in the *P. miniata* model using NCBI databases. Then, western blotting and RT-PCR experiments were performed to identify relative protein and mRNA expression levels for both HSP70 and HSP90. The expression of these HSPs significantly changes during the course of fertilization, indicating that they may have important functional roles at sperm and egg fusion.

2534 - **Blood Steroid and EDC Metabolite Concentrations in Exposed Mice Plasma**

Lawrence Barnoski, Joushua Mogus

East Carolina University, Greenville, NC

Sex steroids are critical for fetal development and sexual differentiation. Disruption of steroid signaling and function during these critical periods can lead to malformation. Humans are exposed to an astounding number of environmental pollutants that disrupt endocrine function. In fact, the rise in reproductive developmental disorders can be linked to these chemicals, collectively known as endocrine disrupting chemicals (EDCs). Vinclozolin, an agricultural fungicide, is a model EDC in rodents used to induce the congenital penis deformity, hypospadias. Hypospadias is a malformation of the male reproductive organs resulting in altered urethral placement. Vinclozolin and its metabolites (M1 and M2) can bind the androgen receptor inducing downstream cascades ultimately masculinizing the genitalia. Although this mechanism is well known, the influence of vinclozolin on hormone concentrations is unknown. Here, we test the hypothesis that vinclozolin alters sex hormone concentrations in both male and female fetuses, and quantify and compare vinclozolin and its metabolite concentrations in both sexes. Pregnant mice were dosed with 125 mg/kg of vinclozolin or corn oil the solvent control. Dam and fetal plasma were collected at embryonic day 16.5. Samples of the mother and embryo blood plasma were collected and analyzed for free and bound steroids as well as metabolites using high-performance liquid chromatography and mass spectroscopy (HPLC-MS). Preliminary results suggest that sex hormones are affected by vinclozolin and that vinclozolin and its metabolites are distributed differently in male and female fetuses. Analysis of blood steroid levels provides a better understanding of the molecular action of EDCs.

2536 - **Characterization of NF-κB deficient bone-marrow macrophages**

Anthony Peppers, Jeffrey Fischer, Jennifer Bradford

Augusta University, Augusta, GA

The nuclear factor-kappaB (NF-κB) signaling pathway is often aberrantly regulated in many different types of cancers, and many cancers have the hallmark of elevated infiltrating macrophages. To better understand the impact of NF-κB signaling between cancer cells and stromal macrophages, we have developed an animal model that lacks canonical NF-κB signaling in bone-marrow derived macrophages (BMDMs). The aim of this study was to characterize NF-κB deficient BMDMs that lack canonical (p65 transcription factor) NF-κB signaling. The macrophages for the study were obtained by harvesting the bone-marrow from p65LysMCre (KO) mice and LysMCre control mice. To determine NF-κB deletion efficiency, p65 protein levels were evaluated by fluorescent microscopy in both KO and control BMDMs that had been stimulated with lipopolysaccharide (LPS). To characterize the NF-κB deficient macrophages, the induction of iNOS was monitored in KO and control BMDMs when activated by NF-κB stimulators IFN-γ and LPS. The regulation of iNOS was assessed by comparing macrophages that had been treated with LPS, IFN-γ, or both to a control treatment under fluorescent microscopy. In addition to staining, a nitric oxide assay was employed to help determine the extent of iNOS activity.

2541 - **Sea Salt Induced Toxicity and the Protective Effects of L-cysteine in *Xenopus laevis* Embryos**

Taylor Pack

Jacksonville State University, Jacksonville, AL

Testing Developmental Toxicants, in Xenopus laevis Embryos, using Sea Salt and L-Cysteine Taylor Pack, Alaa Qrareya, Kristen Carlisle, Dr. James Rayburn Concentrations of Sea Salt (NaCl, sodium chloride) in fresh water environments can result in salt induced toxicity. Responses to increased saline vary among species, but can result in reduced survival, delayed development of larvae and embryos, and increased malformations. L-cysteine has been used in numerous experiments to investigate its protective measures on targeted organs in mice or, in this experiment, aquatic organisms. The objectives for this research is to determine if L-cysteine prevents toxicity of salt stress to embryos of Xenopus laevis. The method used for this experiment is The Frog Embryo Teratogenesis Assay – Xenopus (FETAX), a rapid test for identifying developmental toxicants. Due to the sensitivity of embryonic and early life stages, FETAX provides information that may be useful for estimating the chronic toxicity of a test material to aquatic organisms. Xenopus laevis are bred on campus and the eggs are used for testing. FETAX testing is a 96-hour test that uses small cell blastula stage embryos. These embryos are sorted and separated out into 10 per 60 mm petri dish. Embryos are kept in a 24-degree incubator in the dark for 4 days with solutions being changed every day. Dead embryos are removed every 24 hours and recorded. At 96 hours, mortality, malformation, and embryo length are recorded. Stock solutions of sea salt and L-cysteine, in FETAX solutions, are created and diluted to the appropriate concentration. These final concentrations are placed in the treatment dishes with counted embryos in each. Systat statistical analysis software is used to determine if any treatments are significantly different from any other. Using Probit Analysis, an estimated LC50 and EC50 were generated for this experiment for the sea salt concentrations and sea salt + L-cysteine concentrations. The results of this experiment suggest that L-cysteine may not show any significant effect.

2542 - **The Effects of Nicotine and Niacin on Chemoreception in the fall armyworm, *Spodoptera frugiperda*: New Strategies for Management**

Corey Brooke, Michele Moncrief, Leah Pool, Joanna Gress

Abraham Baldwin Agricultural College, Tifton, GA

The fall armyworm, *Spodoptera frugiperda* (Lepidoptera: Noctuidae), is one of the most detrimental pests of corn and grasses in the Southeastern United States. This pest causes economic losses exceeding $160 million per year. Despite consistent losses resulting from the

fall armyworm, many growers are reluctant to use current integrated pest management (IPM) methods for this insect. This can stem from several factors including; heavy infestations are unpredictable, scouting multiple times each summer takes time and skill, and insecticides are expensive and raise health or environmental concerns. Research towards integrated pest management strategies based on chemoreception has proved promising. Chemoreception is the way an insect perceives its environment and mediates many important pest behaviors including: host plant, mate and oviposition site location. To study the chemoreception response to toxins in the fall armyworms' diet, we conducted a qPCR analysis of *S. frugiperda* caterpillars feeding on an artificial diet. In this study, larvae were fed a diet laced with nicotine and a diet laced with niacin to compare the expression of 18 olfactory- and 5 gustatory-related genes. Nicotine is a potent neurotoxin and is currently utilized in numerous insecticides as a natural combatant to herbivory, whereas niacin is a chemical analog of nicotine found naturally in corn. These results will potentially advance the molecular knowledge of fall armyworm chemoreception and identify candidate genes that may serve as molecular targets for IPM.

2548 - **Molecular Barcoding of the *Anopheles crucians* Complex in the Fred Stanback Jr. Ecological Preserve at Catawba College, Salisbury, North Carolina**

Elizabeth George

Catawba College, Salisbury, NC

The *Anopheles crucians* complex is composed of seven mosquito species that are cryptic based on morphology due to environmental factors such as temperature, sun exposure and geographic distribution, that may create significant changes in these characteristics. Seven sister species of the complex are currently recognized as *An. bradleyi, An. georgianus* and *An. crucians* A, B, C, D and E. Identification at the species level is crucial as the *An. crucians* complex is a vector for viral diseases such as West Nile Virus and Eastern Equine Encephalitis. To circumvent this difficulty, a molecular assay for the conserved ITS2 gene that exhibits high interspecific and low intraspecific variability was developed by Wilkerson et al. (2004). We therefore hypothesized that application of the ITS2 barcoding assay to collections of *An. crucians* from the Catawba College Fred Stanback Jr. Ecological Preserve (FSJEP) would allow us to not only investigate population shifts over time, but work toward linking species identification via molecular barcoding with morphological characters. Here we discuss standardization of this assay for our laboratory, confirmed complex species in the FSJEP, and the examination of a secondary barcoding assay using 18S ribosomal gene sequence.

2555 **- Life History Details of *Procambarus versutus: Ex Situ* Brood Batch Data**

Meet Patel, Randall Bassham, Emily Andersen, Kellan Hoffman

Troy University, Troy, AL

Currently, about 97 native species of crayfish are known to occur in Alabama, meanwhile 44 are state listed. Information on life histories for most species is limited, particularly details about fecundity due to the rarity of ovigerous female collections. The objective of this research was to obtain brood size data from ovigerous females of Procambarus versutus, the Sly Crayfish, raised in the laboratory to supplement the lacking fecundity data from a previous life history study. Reproductively active males and females were collected from Beeman Creek in Pike County, Al and were housed in aquaria to allow copulation and egg production at the Environmental Research Laboratory, Troy University. Data were obtained in house from eight ovigerous females, with egg counts ranging from 96 - 216 and a mean of 145. The maternal carapace length varied from 23.39 to 29.21 mm and mean egg diameters varied from 1.73 to 2.26 mm. Maternal carapace length was highly correlated to mean egg diameter ($r = 0.867$, $p = 0.001$); however, there was no significant correlation between the maternal carapace length and brood size. Three additional ovigerous females were observed with dead and/or decomposing eggs; however, data were not collected from these individuals. This study

provides new methods that showed to be easily attainable for obtaining data on brood size for crayfish life history studies relative to field collections. Future research should be performed to determine if our methods are effective in producing data on other species of crayfish to supplement the lacking life history and brood size data.

2558 - **Mussel Survivability In-House Simulating Reservoir Drawdown Conditions**

Emily Andersen, Lauren Conklin

Troy University, Troy, AL

Little information is available on the tolerances of mussels to desiccated environments, such as severe drought or reservoir drawdown conditions. The drawdown of Point A Reservoir, located near Andalusia, Alabama, prompted a study to determine the effects of the drawdown on the reservoir's mussel community. Two species of mussels, Elliptio pullata and Utterbackia imbecillis, were collected from Point A Reservoir for an in-house study to determine mussel survivability and temperature tolerance in conditions that mimic that of a drained reservoir. A total of 30 mussels from each species were housed in individual beakers containing about 3 cm of sand, and were evenly divided within larger temperature controlled tanks set at 22°C, 28°C, and 33°C to determine the number of days mussels could survive conditions simulating to the drawdown. Mussels were checked for viability every day for the first week and 3 times a week for the remainder of the study until all mussels were dead. At 33°C, U. imbecillis had a mean survival rate of 1.5 d (SD = 0.5, 95% CI [1.2, 1.8]), while E. pullata had a mean survivability of 4 d (SD = 0.8, 95% CI [3.5, 4.5]). Utterbackia imbecillis at 28°C had a mean survivability of 2 d (SD = 0.8, 95% CI [1.5, 2.5]), whereas E. pullata, housed at the same temperature, resulted in a mean survivability of 12 d (SD = 5.9, 95% CI [8.3, 15.7]). At 22°C, the mean survivability of U. imbecillis was 2.5 d (SD = 8.8, 95% CI [14.1, 25.0]), and the mean survivability of E. pullata was 19.6 d (SD = 0.5, 95% CI [2.2, 2.8]). Elliptio pullata showed more resilience to the study conditions than U. imbecillis, and overall survivability increased as the housing temperature approached 22°C. Our study suggested that under in-house conditions mimicking the drawdown, mussels could survive up to 34 days.

2572 - **Preliminary Results of the Effect of Apple Snail Egg Protein Extract on African Clawed Frog Embryos**

Alexandra Partridge

Jaxksonville State Univerity, Jacksonville, AL

Pomacea canaliculata, commonly known as "apple snails", are an invasive freshwater species predominantly found in temperate regions and subtropical and tropical regions worldwide (Heras, 2006). Apple snails have adapted to deposit their eggs above the waterline in clutches surrounded by a perivitellin fluid that gives it a pink-reddish warning coloration. These eggs contain a toxin of proteinaceous nature that in some cases lead to neurological damage and even fatality (Heras, 2008). The toxicity of the egg extract was studied on *xenopus laevis* embryos because of their short and simple developmental stages. The goal was to test the invasive egg cases potential toxicity levels on the *xenopus laevis* (African clawed frog) using different concentrations of egg extract and FETAX. Groups of ten tadpoles were exposed to different concentrations of egg mass centrifuged for 10 minutes at 1000 RPM and blended with FETAX solution. Each group was incubated and death rates calculated after 24 hours of exposure. Experiments showed 100% fatality in 48-hour old *xenopus laevis* tadpoles at concentrations 50,000 µg/mL and higher. Further studies revealed death rate of 24% on 24-hour old tadpole groups at concentrations low as 62.5 µg/mL. Once a range of survival was found, a set of experiments was used to collect data to show the effects of the apple snail egg extract on the *xenopus laevis* embryos using concentrations 20µg/mL to 5,000µg/mL. Almost all the tadpoles in the control groups, exposed to only FETAX solution, survived. Experimental results supported that the toxicity of the *pomacea canaliculata* is enough to kill *xenopus laevis*

embryos in early developmental stages. These results are preliminary and develop a starting point for subsequent research on the toxicity of apple snail eggs.

2583 - **Effect of Nerve Growth Factor on Cardiomyocyte Proliferation after Induction of Hypoxia**

Trevond Sellers, Elizabeth Klar, Kathleen Hughes

Columbus State University, Columbus, GA

Myocardial Infarctions (MI), commonly known as a heart attack, is a leading cause of death in the United States with more than 1.5 million cases annually. MIs are caused by blocked arteries which cause damage to cardiomyocytes due to lack of oxygen. Limited research has been conducted on the effects of nerve growth factor (NGF) on proliferation of heart cells after an infarction. This study used rat myoblast cells that were exposed to hypoxia and then treated with NGF as a post treatment. The cultures were incubated at 37°C and exposed to an hour of hypoxia once 80% confluent. After the hypoxia, cells were treated with two different amounts of NGF, 75 ng/ml or 150 ng/ml, and observed at three intervals 6, 12, and 24 hours. Controls were also included: normal cells and 150ng/ml NGF and hypoxia cells with no NGF. Cells were collected at the time intervals and cell viability was determined using trypan blue and a Bio Rad cell counter. The data was not significantly difference across treatments after running a MANOVA. Since the cells showed continued proliferation under the effects of NGF further studies might show if NGF could be an effective treatment following an MI.

2590 **- Influence of Nerve Growth Factor Dosing Intervals on Muscular and Functional Regeneration in Mice after Acute Myocardial Injury**

Michael Sandak[1], Elizabeth Klar[1], John Calvert[2], Brian Schwartz[1]

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Growth factors have become prominent in a variety of studies for inducing cell survival and proliferation in damaged tissue. Nerve growth factor beta (NGFβ), a neurotrophin, has shown promising results for apoptosis avoidance and angiogenesis in cardiac repair following myocardial infarction. Thus far, the beneficial mechanisms of NGFβ have been attributed to its binding of the tyrosine kinase receptor A (TrkA), which bifurcates into additional pathways contributing to the cellular reactions to either survive or divide. However advantageous the effects of NGFβ might be, there is little research on the appropriate dosing parameters to optimize the activation of the TrkA pathway. Considering previous pharmacokinetic research, we performed an in vivo drug efficacy study on the mammalian heart after infarction. For two weeks, the experimental groups received injections, either NGFβ or saline, every 72 hours. The interval of time between injections, 72 hours, was determined by the time it takes the inflated neurotrophin levels to be returned to baseline levels. Histological analyses assessed cardiac muscle regeneration and ejection fraction from echocardiography measurements were performed to assess functional regeneration. Preliminary results suggest a difference in survival rates between treatments groups.

2595 - **Analysis of variation in *Microtus* (Rodentia: Arvicolini) teeth from the Pleistocene Bell Cave deposit of northwestern Alabama**

Adriana Smolik

Jacksonville State University, Jacksonville, AL

Bell Cave, Alabama, preserves a multi-fauna Ice Age (Pleistocene) deposit including mammals, birds, herpetofauna, and fishes. Microvertebrate fossils make up the bulk of this material, and include numerous species, including the vole *Microtus* (Rodentia: Arvicolini). Whereas *Microtus* from Bell Cave has been published previously, the collection of new fossil

material warrants revisiting the hypotheses of those studies in light of larger sample sizes. The purpose of this study is to provide a formal description and quantitative analysis of the variation among *Microtus* teeth collected. All teeth were taken from a single site and sorted into zones (1–4) that correlate to the stratigraphic level at which the teeth were found to correct for any morphological changes through time. Teeth were photographed in occlusal view using an AmScope MU 300 digital camera attached to a Nikon SMZ-U Stereoscopic Zoom Microscope and enhanced with Adobe Photoshop CS6. Two-dimensional morphometrics were conducted using MorhoJ. Preliminary results indicate that the first molars show no significant differences, stratigraphically or contralaterally (when right and left specimens were included). Future work will include similarly testing different tooth positions from Zones 3 and 4.

2601 - ***Taming of the Brew:*** **Developing Techniques to Streamline Isolation and Genetic Identification of Wild Yeast Strains from Rowan County, North Carolina**

Lee Brackman

Catawba College, Salisbury, NC

Breweries worldwide have been interested in isolating wild yeast, specifically *Saccharomyces* species, to produce novel varieties of beer. The current protocol used in our laboratory (Garcia et. al., 2017, unpublished) to isolate wild yeast strains from their bacterial counterparts follows methods that are time-consuming and variable. Consequently, we sought to develop a more efficient method for yeast isolation. We hypothesized that the application of antibiotics in our selection of axenic yeast strains would result in a quicker isolation process. To determine the optimal antibiotic for method development, we set-up preliminary trials of crude sample with a panel of five antibiotics. Three had the greatest efficacy at eliminating bacterial species while allowing for yeast isolate growth: Chloramphenicol (30 µg/mL), Streptomycin (10 µg/mL), and Ampicillin (10 µg/mL). We next infused yeast growth media (YM) with varying concentrations of Chloramphenicol (30-3000 µg/ml), Streptomycin (10-1000 µg/ml) and Ampicillin (10-1000 µg/ml). Compared with non-antibiotic control YM plates, each antibiotic successfully inhibited bacterial growth while promoting yeast colony growth. Here we discuss the differences in efficiency between the original versus antibiotic-adapted method, the strains subsequently isolated and identified via ITS barcoding analysis, and our suggestions for those interested in taming the wild brew.

2602 - **Environmental Mercury in Domestic Cats**

Dina Reyes, Joe Poston

Catawba College, Salisbury, NC

Mercury is a highly toxic element that is released into the atmosphere from human activity such as the burning of fossil fuels. From the atmosphere, the mercury settles on terrestrial and aquatic ecosystems and is incorporated by plants and animals. The purpose of this research project is to determine if domestic cats are exposed to environmental mercury by eating foods that contain mercury, or by eating wild birds or mammals that have mercury within their bodies. We analyzed mercury content in cat food and in fur samples provided by cat owners. The cat owners completed a questionnaire about the diet and housing of their cat(s). The data collection and analysis currently are underway. We will present the latest findings from our project. This research could help cat owners reduce their cat's exposure to mercury by revealing which aspects of a cat's diet and housing are correlated with mercury load.

Association of Southeastern Biologists

79th Annual Meeting

UNC PEMBROKE

COASTAL CAROLINA UNIVERSITY

BARUCH INSTITUTE FOR MARINE AND COASTAL SCIENCES
UNIVERSITY OF SOUTH CAROLINA

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Myrtle Beach Sheraton and Convention Center
March 28 – March 31, 2018

Celebrating 80 Years of Science in the Southeast!

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Affiliate Societies

Beta Beta Beta Southeastern District I	**Beta Beta Beta Southeastern District II**	**Botanical Society of America, Southeastern Section**
National Association of Biology Teachers	**Ecological Society of America, SE Chapter**	**Society of Herbarium Curators, SE Section**
Southern Appalachian Botanical Society		

Registration and Exhibit Hall Hours

Exhibit Hall A is the hub of our conference. Registration, along with vendors and academic programs, are located in the hall. New this year is a **Cash Bar** open during our **PM Posters Sessions**, and a **Lounge Area**. Of course all **coffee breaks** and the **Silent Auction** will be there as well. Come Enjoy the Hall with colleagues and friends!

	Registration	Exhibits Open
Wednesday	11:00 AM – 9:00 PM	8:00 PM – 9:30 PM
Thursday	7:00 AM – 5:30 PM	8:00 AM – 5:00 PM
Friday	7:00 AM – 12:00 PM	8:00 AM – 5:30 PM

Silent Auction

***Organizers**: Rebecca Cook, Jenny Davis, Jennifer Mandel, Dawn Wilkins*

Established in 2006, The Silent Auction raises money to fund the Graduate Student Support Award which helps defer travel costs for graduate student members presenting papers/posters at the Annual Meeting. Over the last 3 meetings (2015, 2016, 2017), the auction has generated $11,000 and ASB has supported 51 graduate students for a total of $12,600. ASB has committed to supplement the auction proceeds, yearly, with and additional $5000. This year (2018) we will support a total of 17 students.

Bring your donation to Silent Auction Area (Exhibit Hall before 10:00 am, Thursday, March 29).

ASB 2018 Exhibitors

Thank you to our wonderful Exhibitors for their support of ASB!

Coastal Carolina University, School of the Coastal Environment - *The Department of Coastal and Marine Systems Science at Coastal Carolina University offers two graduate degree options: Ph.D. in Marine Science the M.S. in Coastal Marine and Wetland Studies.*

Francis Marion University - *Francis Marion University is a four-year public institution established by the state of South Carolina. It is located in the northeastern part of the state near the city of Florence and has nearly 4,000 students.*

University of North Carolina Pembroke

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University of South Carolina Baruch Institute

Associated Microscope

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Carolina Biological Supply - *Carolina gives science educators one reliable source for everything from quality laboratory equipment and chemicals to living and preserved specimens.*

Eastern Kentucky University

HHMI Biointeractive - *HHMI BioInteractive develops free resources, including short films, virtual labs, apps, and print materials that are based on real data and highlight the science practices.*

iDigBio - *We are Integrated Digitized Biocollections (iDigBio), the National Resource for Advancing Digitization of Biodiversity Collections (ADBC) funded by the National Science Foundation.*

James Madison University, Department of Biology

Martin Microscope Company - *Martin Microscope is a leading distributor of microscopes and imaging equipment, in the microscopy business in the Southeast for over seventy years.*

Southern Appalachian Botanical Society - *Southern Appalachian Botanical Society (SABS) focuses on the botany of the eastern states. The membership includes botanists from across the country. Find more info from sabs.us.*

Thermo-Fisher Scientific - *Discover life-changing answers faster. Basic life processes start in the cell. To understand how cells function and respond to disease or genetic variations, life scientists engage in cellular and structural biology research.*

University of Tennessee at Martin

Vashaw Scientific - *Vashaw Scientific is the Southeast regional dealer for Carl Zeiss Microscopes, and are proud to represent a broad portfolio of additional prestigious manufacturers.*

Winthrop University

R. H. Martin Plenary Address

The Honorable Dr. Jane Lubchenco

University Distinguished Professor and Marine Studies Advisor to the President
Oregon State University, Department of Integrative Biology
Former U.S. Under Secretary of Commerce for Oceans and Atmosphere
Former Administrator of the National Oceanic and Atmospheric Admin. (NOAA)
Member, President Barack H. Obama's Science Team (2009-2013)

Science in a post-truth world

Wednesday, March 28th • 7:00 PM – 8:00 PM • Ballroom A-D

Jane Lubchenco, University Distinguished Professor at Oregon State University, is a marine ecologist with expertise in the ocean, climate change, and interactions between the environment and human well-being. She served as Under Secretary of Commerce for Oceans and Atmosphere and Administrator of the National Oceanic and Atmospheric Administration (NOAA) and as part of President Barack Obama's Science Team (2009-2013), and as the first U.S. Science Envoy for the Ocean, a *pro bono* position with the State Department (2014-2016). She is one of the "most highly cited" ecologists in the world with eight publications as "Science Citation Classics." She received her PhD in ecology from Harvard University and is a member of the National Academy of Sciences, The American Philosophical Society, the Royal Society and other distinguished academies. She has received numerous awards including 20 honorary doctorates and the highest honor given by the National Academy of Sciences, the Public Welfare Medal. She co-founded three organizations that train scientists to be better communicators and engage more effectively with the public, policy makers, media and industry: The Leopold Leadership Program, COMPASS, and Climate Central. She is passionate about scientists engaging with citizens to create knowledge and craft durable solutions to enable vibrant communities, strong economies and a healthy planet.

Association of Southeastern Biologists Meeting-At-A-Glance

Wednesday March 28th – March 31st 2018
Myrtle Beach Sheraton and Convention Center

Wednesday, March 28th

Time	Event	Location
9:00 AM – 4:00 PM	Exhibitor Set-up	Exhibit Hall A
11:00 AM – 9:00 PM	**Registration Open**	Exhibit Hall A
11:00 AM – 2:00 PM	Exhibitor Break (exhibitors only)	Exhibit Hall A
1:00 PM – 6:00 PM	**ASB Executive Committee Meeting**	Room 202-204
1:00 PM – 6:00 PM	**SABS Executive Council Meeting**	Room 206-208
6:00 PM – 7:00 PM	**Welcome Reception**	Exhibit Hall A
7:00 PM – 8:00 PM	**R. H. Martin Plenary Address** **The Honorable Dr. Jane Lubchenco** University Distinguished Professor and Marine Studies Advisor to the President Department of Integrative Biology Oregon State University Former U.S. Under Secretary of Commerce for Oceans and Atmosphere Former Administrator of the National Oceanic and Atmospheric Administration (NOAA) President Obama's Science Team (2009-2013) Former U.S. State Dept. Science Envoy for the Ocean **SCIENCE IN A POST-TRUTH WORLD**	Ballroom A-D
8:00 PM – 9:00 PM	**After-Plenary Social**	Exhibit Hall A
9:00 – 'till	Town Painting	Myrtle Beach

Thursday, March 29th
AM Sessions

Time	Event	Location
7:00 AM – 5:30 PM	**Registration Open**	Exhibit Hall A
7:00 AM – 5:00 PM	PowerPoint Preview Check	Room 207
7:00 AM – 8:00 AM	**ASB Past President's Breakfast Meeting**	Room 104

7:00 AM – 5:30 PM	**ASB POSTER SESSIONS** **ASB Posters (1-172, Sessions 1 & 2) set up 7:00 – 8:00 AM** Presenters of **odd-numbered posters** (Poster Session 1) must be present 9:15 – 10:30 am Presenters of **even-numbered posters** (Poster Session 2) must be present 4:15 – 5:30 pm **ALL posters must be removed at end of PM session**	Exhibit Hall A
8:00 AM – 5:30 PM	**Exhibits Open**	Exhibit Hall A
8:00 AM – 11:45 AM POSTER SESSION 1 & COFFEE BREAK 9:15 AM – 10:30 AM IN EXHIBIT HALL	**ASB Workshop** Natural History Collections Clubs Network (NHCCN): Advantages and Challenges of Starting a Natural History Collections Club at your Institution **Organizers** Travis Marsico (Arkansas State Univ.) Kari Harris (Arkansas State Univ.)	Room 102/103
8:00 AM – 11:45 AM POSTER SESSION 1 & COFFEE BREAK 9:15 AM – 10:30 AM IN EXHIBIT HALL	**ASB Paper Presentations and Symposia** Cell and Molecular Biology 1 Ecosystem and Landscape Ecology Invertebrate Biology Plant Systematics Population and Community Ecology 1 **Symposium** The 2016 Fire Season of the Southern Appalachian Region **Organizers** Nicole Welch (MS Univ. for Women) Julie Tuttle (Univ. of NC Chapel Hill)	Room 101 Ballroom A Room 107 Ballroom C Room 106 Ballroom B
9:15 AM – 10:30 AM	**POSTER SESSION 1 and Coffee Break** No talks at this time Presenters of **odd-numbered posters** (**1 - 172**) must be present at this time	Exhibit Hall A
11:45 – 1:15 PM	**LUNCH BREAK** **SHC SE Chapter Luncheon/Business Meeting** **ASB Diversity Committee Lunch**	Room 104 Room 105

Thursday, March 29th PM Sessions Coffee available in Exhibit Hall A from 2:15 PM – 4:45 PM		
Time	**Event**	**Location**
1:15 PM – 3:30 PM COFFEE BREAK 2:15 PM - 2:30 PM IN EXHIBIT HALL	**ASB Workshop** Developing Research-Infused Curricula for Undergraduates **Organizer** Jennifer Rhode Ward (Univ. of NC, Ashville) Alisa Hove (Warren Wilson College)	Room 102/103
1:15 PM – 3:30 PM	**ASB Paper Presentations and Symposia** Cell and Molecular Biology II Herpetology Plant Floristics Plant Physiology Population and Community Ecology II **Symposium** The 2016 Fire Season of the Southern Appalachian Region II **Organizers** Nicole Welch (MS Univ. for Women) Julie Tuttle (Univ. of NC Chapel Hill) **Symposium** Hurricane Impacts on Coastal Freshwater Systems **Organizers** William Connor and Jamie Duberstein (Baruch Institute of Coastal Ecology and Forest Science)	Room 101 Room 107 Ballroom C Ballroom A Room 106 Ballroom B Room 108
3:30 PM – 4:45 PM	**POSTER SESSION 2 & Coffee Break** Presenters of **even-numbered posters (1-172)** must be present at this time. **ALL posters must be removed at end of PM session**	Exhibit Hall A
4:45 PM – 5:30 PM	**ASB 'State of Our Society' Members' Meeting**	Ballroom B
4:45 PM – 5:45 PM	**SABS/BSA Students' Reception**	M-Bar
6:00 PM – 10:00 PM	**ASB Thursday Night Social** Live Music, Food, Drinks, Games, and more Drinks! Transportation to/from Riptydz 5:45 pm to 11:00 pm	RipTydz Oceanfront Grille & Rooftop Bar
10:00 PM – 'till	Town Painting: 2nd coat!	Myrtle Beach

	Friday, March 30th AM Sessions	
Time	**Event**	Location
7:00 AM – 12:00 PM	**Registration Open**	Exhibit Hall A
7:00 AM – 8:00 AM	SABS/BSA Breakfast Meeting	Room 104/105
7:00 AM – 5:00 PM	PowerPoint Preview Check	Room 207
7:00 AM – 5:00 PM	**ASB POSTER SESSIONS** **ASB Posters (173-336, Sessions 3 & 4)** **Set up 7:00 – 8:00 AM** Presenters of **odd-numbered posters** (Poster Session 3) must be present 9:15 – 10:30 am. Presenters of **even-numbered posters** (Poster Session 4) must be present 4:30 – 5:45 pm. **ALL posters must be removed at end of PM session**	Exhibit Hall A
8:00 AM – NOON	**βββ POSTER SESSIONS** β β β Poster set up 8:00 AM – 9:00 AM Presenters must be present 9:30 AM – NOON	Exhibit Hall A
8:00 AM – 6:00 PM	**βββ Officers & Judges Room**	Room 202
9:00 AM – 9:30 AM	**β β β Joint Business Meeting (all delegates MUST attend)**	Room 206/208
8:00 AM – 11:45 AM POSTER SESSION 3 & COFFEE BREAK 9:15 AM – 10:30 AM IN EXHIBIT HALL	**ASB Paper Presentations and Symposia** Animal Behavior Aquatic Ecology I Conservation Ecology I Evolution and Genetics Scholarship of Teaching and Learning **Symposium** SouthEast Regional Network of Expertise and Collections (SERNEC): Progress and Prospects **Organizer** Zach Murrell (Appalachian State University)	Room 108 Room 106/107 Ballroom A Ballroom B Room 101 Ballroom C

9:15 AM – 10:30 AM	**POSTER SESSION 3 & Coffee Break** No talks at this time Presenters of **odd-numbered posters (173-336)** must be present at this time.	Exhibit Hall A
11:45 AM – 1:15 PM	**LUNCH BREAK** **ASB Education Committee: Teaching & Learning Luncheon** **ESA Luncheon and Business Meeting**	Room 104 Room 105
Friday, March 30th **PM Sessions** **Coffee available in Exhibit Hall A from 2:30 PM – 5:15 PM**		
Time	**Event**	**Location**
1:15 PM – 4:00 PM	**ASB Paper Presentations and Symposia** Animal Behavior/Entomology Aquatic Ecology II Conservation Ecology II Microbiology Plant Collections and Herbaria **Symposium** Ecology in a High Speed Landscape **Organizers** Julie Zinnert (Virginia Commonwealth Univ.) Charles Kwit (Univ. of TN Knoxville)	Room 108 Room 106/107 Ballroom A Room 101 Ballroom C Ballroom B
1:30 PM – 4:00 PM COFFEE BREAK 2:30 PM - 2:45 PM IN EXHIBIT HALL	**ASB Workshop** Using the Motus Wildlife Tracking System to Study Avian Migration Pathways **Organizers** Kara Lefevre (Florida Gulf Coast Univ.) Adam Smith (USFWS-National Wildlife Refuge System) **Bringing a Laptop is useful but not mandatory**	Room 102/103
1:30 PM – 4:00 PM	**βββ Paper Presentations** District I — District II —	Room 204 Room 206/208
4:00 PM – 5:30 PM	**POSTER SESSION 4 and Coffee Break** **ASB Presenters** of **even-numbered posters (173-336)** must be present at this time. **Closing Shenanigans** **Raffles and Tip Racking Contest**	Exhibit Hall

4:30 PM – 5:00 PM	**β β β District Session Meetings** District I – District II –	Room 204 Room 206/208
5:00 PM – 6:00 PM	**β β β Joint Session and Awards**	Room 206/208
5:30 PM – 6:00 PM	**NSF Research Funding Opportunities in the Biological Sciences (all welcomed)**	Ballroom B
6:30 PM – 9:00 PM	**ASB Awards Banquet**	Ballroom DE
9:00 PM – 'till	Town Painting: Trim!	Myrtle Beach

Saturday, March 31st

Time	Event	Location
8:00 AM – 2:30 PM	**FIELD TRIP to Baruch Marine Field Laboratory** **Organizer** Baruch Institute of Coastal Ecology and Forest Science	Departure from Conference Hotel at 8:00 AM
7:30 AM – 8:30 AM	**ASB Executive Committee Breakfast**	Room 106/107
8:30 AM – NOON	**ASB Executive Committee Meeting**	Room 106/107

CONVENTION CENTER MAP

Hotel Parking - $8 per day/per vehicle for overnight guests in the Hotel's attached garage. Unlimited in and out privileges

Conference Center Parking - $5 per day/per vehicle

Internet Access - WiFi is complimentary throughout convention center PASSWORD is **convention** (all lower case).

Symposia

THURSDAY 08:00 AM – 3:30 PM Ballroom B	**The 2016 Fire Season of the Southern Appalachian Region** **Organizers:** *Nicole Welch (MS Univ. for Women) and Julie Tuttle (Univ. of NC Chapel Hill)* The 2016 fire season renewed a great deal of ecological and policy interest in the Southern Appalachian region of the Southeastern United States. While fire played a prominent historical role in shaping this region's landscape, decades of fire exclusion and suppression policies and limited use of prescribed burning resulted in fire-adapted pine-oak ecosystems with large fuel loads and altered biotic communities. Frequent extended periods of drought over the last 20 years, combined with atypical weather patterns in 2016, set the stage for numerous fire events in Fall 2016. Most newsworthy of these fires were those in the Great Smoky Mountains National Park and surrounding towns because of their human and economic impacts. Regionally, many fires burned in pine-oak forests and, over time, will test the ecological resiliency of these ecosystems. This symposium examines the 2016 fire season of the Southern Appalachian region with particular interest paid to its meteorological conditions, pre- and post-burn forest conditions and composition, and economic impact. Southeastern fire-adapted ecosystems continue to be impacted by fire suppression and exclusion policies operating in times of increased climatic variability. The fire history of the region should play a prominent role in advising future fire management policy.
THURSDAY 1:15 PM – 3:30 PM Room 108	**Hurricane Impacts on Coastal Freshwater Systems** **Organizer:** *William Connor and Jamie Duberstein (Baruch Institute of Coastal Ecology and Forest Science)* Hurricanes are normally large infrequent disturbances that impact coastal freshwater ecosystems triggering responses that cause multiple paths of ecosystem response or even complete shifts of ecosystem function or type in systems exposed to chronic stress. In the last three years, South Carolina has seen a number of events that have significantly impacted its coastal wetlands (Hurricane Joaquin in 2015, Hurricane Matthew in 2016, and Hurricane Irma in 2017). The opportunity presented by these events arises from the fortuitous track of these storms impacting long-term research sites, providing the ability to compare impacts of differing storm intensity on community structure and health. In this symposium, speakers will examine the hydrological, biological, and biogeochemical impacts of hurricanes on coastal freshwater systems.
FRIDAY 08:00 AM – 11:45 PM Ballroom C	**SouthEast Regional Network of Expertise and Collections (SERNEC): Progress and Prospects** **Organizer:** *Zach Murrell (Appalachian State University)* Dr. John Herr had many impacts on biology in the southeast USA over the course of his lifetime. This symposium is designed to honor those efforts and to highlight the impact a life of service can have on our society. Dr. Herr was instrumental in the development and maintenance of several professional organizations. These organizations, in an extension of his efforts, have had a tremendous impact on the region. Dr. Herr's efforts in support of herbaria resulted in the development and growth of the Society of Herbarium Curators and the SouthEast Regional Network of Expertise and Collections (SERNEC), a project sponsored by the Southeast Chapter of the Society of Herbarium Curators.

FRIDAY 1:15 AM – 4:00 PM Ballroom B	**Ecology in a High Speed Landscape** **Organizers:** *Julie Zinnert (Virginia Commonwealth Univ.) and Charles Kwit (Univ. of TN Knoxville)* Along the US Atlantic and Gulf Coasts, coastal systems are highly developed and populated landforms that are increasingly vulnerable to numerous factors affiliated with global change. These include sea-level rise and extreme events such as storms (including hurricanes), while experiencing changes in flora and fauna associated with global warming, ocean acidification, and other invasive processes. Coastal systems are characterized as high stress environments, where physical factors (i.e. light, temperature, salinity) are considered to dominate ecological processes. Recent research has emphasized the importance of species composition, dispersal, nutrients, and species interactions in shaping communities and enhancing resilience to disturbance. Coastal ecological communities provide numerous important ecosystem services, yet there is relatively limited understanding of the effects of global change on these communities. Rising air and ocean surface temperatures are expected to change precipitation patterns, while hurricanes and other coastal storms are expected to increase in frequency and intensity. Anthropogenic pressures and introduction of new species are increasingly important in defining and affecting coastal processes. This symposium features new research in ecological responses to global change-related factors in Southeastern coastal ecosystems. Through increasing our awareness of the ecological processes and interactions with physical factors, we can improve predictions of coastal change for coastal management and conservation.
Workshops	
THURSDAY 8:00 AM – 11:45 AM Rooms 102/103	**Natural History Collections Clubs Network (NHCCN): Advantages and Challenges of Starting a Natural History Collections Club at your Institution** **Organizers**: *Travis Marsico (Arkansas State Univ.) and Kari Harris (Arkansas State Univ.)* The NHCCN is focused on generating and maintaining student interest in biodiversity collections by providing them access to curators and mentors and to other students with similar interests. The purpose of a multi-institution network is to increase accessibility of intellectual resources for club advisors and graduate and undergraduate student members. Through their involvement with Natural History Collections Clubs (NHCCs), students are empowered to take leadership roles in their universities' natural history collections. The current network is made of several clubs that are curator-advised, student-driven organizations aimed at enhancing local natural history collections by helping to train student volunteers to assist in curating and managing them. This workshop will explore the advantages and challenges of starting a NHCC at your institution as well as other strategies for getting students more involved in collections. This workshop will focus on participant discussion and questions with individuals (faculty members and students) who are running successful active clubs. The format is not a series of lectures, but an interactive workshop to kick start NHCCN clubs.

THURSDAY 1:15 PM –3:30 PM Rooms 102/103	**Developing Research-Infused Curricula for Undergraduates** **Organizers:** *Jennifer Rhode Ward (Univ. of NC, Ashville) and Alisa Hove (Warren Wilson College)* Faculty from four liberal arts and masters'-granting institutions have developed inquiry-driven curricular modules focused on assessing plant ecological responses to global change in the Southern Appalachians. This place-based educational network utilizes regional environmental issues to impart botanical knowledge while encouraging higher-order cognitive processes, advancing quantitative literacy, teaching analytical techniques, honing scientific communication skills, and improving persistence and graduation in STEM majors. Our collaboration is based on the notion that students meaningfully engage with STEM when motivated and challenged by the process of working on real projects whose findings may extend beyond the classroom. In this workshop, we will share classroom and laboratory exercises that use authentic inquiry to generate publishable data; these have been shown to increase student understanding and engagement, and to develop knowledge bases. Workshop participants will discuss strategies for securing internal institutional support for research-infused curricula. Finally, the workshop will guide participants as they develop new CUREs (course-based undergraduate research experiences), related to their own areas of scholarly expertise.
FRIDAY 1:30 PM – 4:00 PM Rooms 102/103	**Using the Motus Wildlife Tracking System to Study Avian Migration Pathways** **Organizers:** Kara Lefevre (Florida Gulf Coast Univ.) and Adam Smith (USFWS- Nat. Wildlife Refuge System) The global study of migratory birds is being boosted by technological advances such as public databases and the use of geolocators, increasingly miniaturized GPS loggers, and other tools. To wit, Motus is an automated radiotelemetry network that is enabling powerful new insights about the routes, rates, and stopover behavior of individual migratory organisms. The workshop will share knowledge about how the Motus network is augmenting knowledge via its hemispheric collaboration among government scientists, academics, non-profit organizations and citizens. We will explore how the southeastern USA figures prominently in the migratory connectivity of New World landbirds, yet the region is poorly represented within the current footprint of Motus receiving stations. This is relevant because landscapes around the Gulf of Mexico and the Southeast Atlantic Coast provide habitats and connectivity for Nearctic–Neotropical migratory landbirds that travel between their North American breeding grounds and tropical wintering grounds in the Caribbean and Central and South America. A better understanding of migration ecology throughout the southeast will support management efforts for those species. The workshop will share updates about current Motus efforts in the southeast, and will provide logistical advice to researchers interested in getting involved in Motus by establishing a receiving station or affixing nanotags to migratory animals for studies of movement ecology.

Oral Presentations

Thursday AM, March 29th

Time	Ecosystem and Landscape Ecology Ballroom-A	Symposium: Fire Season of the Southern Appalachian Region Ballroom-B	Plant Systematics Ballroom-C	Cell and Molecular Biology I Room 101	Population and Community Ecology I Room 106	Invertebrate Biology Room 107
8:00 AM	The Effect of Different Fish Predators on Riparian Spider Mercury Concentrations **Gale Beaubien**, Connor Olson, Scott Rush and Ryan Otter	Opening Remarks. **Nicole Welch** and Julie Tuttle	Taxonomy of *Diervilla* P. Miller (Bush-honeysuckle; Caprifoliaceae) **Kathy Mathews** and Hannah Meeler	Understanding the Role of Ubiquitin during the Elimination of Paternal Organelles in *C. elegans* **Paola Molina** and Lynn Boyd	High soil salinity reduces maritime forest regeneration **Natasha Woods** and Julie Zinnert	*Investigating causes of ontogenescence by examining barnacle hatching success* **Brennan Fitzgerald**, M. Chase Freeman and Paul Dunn
8:15 AM	Relationships between water quality and macrophyte communities associated with the 2015 Florida Bay seagrass die-off. **J. Fredley** , M. Durako	Fire History, the Wildland-Urban Interface, and Future Wildfires in the Southeastern U.S. **Henri Grissino-Mayer**, Charles Lafon and Sally Horn	Niche Separation of Virginia Populations of the *Viola Subsinuata* Complext Supports Recognition of Four Morphospecies. **Jen Hastings** and Harvey Ballard	Biogeographic distribution of spotted wintergreen (*Chimaphila maculata*) and its application to human skin health. **Erin Moore**, E. Bickenbach, C. Wagner, J. Alley, T. Rathinasabapathy and S. Komarnytsky	Classification of dry coniferous forests and woodlands of the southern Appalachian Mountains **Thomas Wentworth**, Brooklynn Newberry, Michael Lee, Robert Peet, Michael Schafale and Alan Weakley	Towards an enhanced chemotaxis assay of *Caenorhabditis elegans* with microfluidics **Sherif Helmey** and Robert Grammer
8:30 AM	Findings of Undergraduate Students Conducting Ecological Surveys in the BIBB County Glades "Botanical Lost World." **Joshua Fuller**, Thomas Diggs and Evan Lampert		Novel morphologies in the *Allium tricoccum* (Wild Ramps) Complex and their systematic impact **B. Sitepu** and Harvey Ballard	Characterization of the protein-protein interactions associated with the plastid-encoded factor Maturase K **A. Margets** and M. M. Barthet	Long-term Response of Forests Disturbed by Hurricane Hugo in the Coastal Plains of South Carolina, USA **B. Song**, R. Heaton, C. Gresham, W. Conner and T. Williams	Stable inheritance of olfactory imprinting in *Caenorhabditis elegans* **Hope Kramer** and Robert Grammer

Time	Ecosystem and Landscape Ecology Ballroom-A	Symposium: Fire Season of the Southern Appalachian Region Ballroom-B	Plant Systematics Ballroom-C	Cell and Molecular Biology I Room 101	Population and Community Ecology I Room 106	Invertebrate Biology Room 107
8:45 AM	Standing dead trees are a conduit for the atmospheric flux of CH_4 and CO_2 from wetlands **Mary Jane Carmichael**, A. Helton, J. White, W. K. Smith	Weather and climate linkages that set the stage for the 2016 Southern Appalachian fire season **Marcus Williams**, Scott Goodrick and Joseph O'Brien	Morphological and Physiological Comparisons between Yellow Toadflax (*Linaria vulgaris*) Individuals in relation to Auxin Concentrations of Indole-3-Acetic Acid (IAA) and 2,4-Dichlorophenoxyacetic Acid (2,4-D) **Alexander Allmon**	The Effects of Bromocriptine on the Mobility of *Caenorhabditis elegans* with Parkinson's-like Disease **Midya Yarwais** and Nick Ragsdale	Conspecific negative density dependence in American beech **Benjamin Ramage** and Isabel Mangana	Forensic Ecology: The Role of Invasive Species in Estimating "Time of Death" **Ed Mondor**
9:00 AM	Building more resilient ecological and human communities: A project to quantify coastal threats to key fish and wildlife habitat and human community assets and identify opportunities to support high impact "coastal resilience" projects. **R. White**, P. Crist, M. Chesnutt and Greg Dobson		Unexpected genetic diversity in polyploid *Isoetes* revealed with PacBio DNA sequencing **Peter Schafran**, E. Zimmer, C. Taylor and L. Musselman	Investigating the Effect of the NMDA-type Neurotransmitter Glutamate on Habituation in *Caenorhabditis elegans* **Yasmin Telwar,** N.Ragsdale	Can we find our way home? *Gopherus polyphemus* response to relocation. **Noel Cawley**	Assessment of Expert Decisions on Non-Native, Conifer-Specialist Insect Impacts in North America **Ashley Schulz** and T Marsico
9:15 AM	**BREAK for Poster Session 1, Exhibitors, and Coffee** Presenters of ASB **odd-numbered posters** (1 - 172) must be present at this time. **9:15-10:30 AM**					

Time	Ecosystem and Landscape Ecology Ballroom-A	Symposium: Fire Season of the Southern Appalachian Region Ballroom-B	Plant Systematics Ballroom-C	Cell and Molecular Biology I Room 101	Population and Community Ecology I Room 106	Invertebrate Biology Room 107
10:30 AM	Sands of time: a 32 year analysis of the Virginia barrier islands **Ben Nettleton** and Julie Zinnert	Breeding Bird and Herpetofaunal Response to Fire Severity, Repeated Burning, and Mechanical Fuel Reduction In Hardwood Forest **Cathryn Greenberg**, Christopher Moorman, Charlotte Matthews-Snoberger, Joseph Tomcho, Aimee Livings-Tomcho, Amanda Heh, J. Drew Lanham, Thomas Waldrop, Dean Simon and Donald Hagan	The natural history and conservation of *Boechera serotina* (Brassicaceae) in Pendleton County, West Virginia **Conley K. McMullen** and Paul J. Harmon	Investigating the Potential Role of *nsy-1* in Response to an Oxidative Stressor **Taylor Hodge** and Nick Ragsdale	Habitat and Seasonal Preferences of Fiddler Crabs across Gulf Coast Tidal Marsh Vegetation Zones **Gwendolyn Murphy** and Loretta Battaglia	Extended flowering phenology as a shared trait among hubs in a plant-pollinator network **Chelsea Hinton** and Valerie Peters
10:45 AM	Exploring forest fire effects on biodiversity through a novel use of sound **Samuel Crummett** and John Quinn		Preliminary investigation into the taxonomy of the *Clematis viorna* complex (*Clematis* subgenus *viorna*) of the southeastern United States. **Zach Irick** and Dwayne Estes	Isolation of Lysosomes in *Caenorhabditis elegans* **Ryan Fox** and Robert Grammer	Relationships between tree density and the growth and survival of longleaf pine (Pinus palustris) at Blackwater Ecological Preserve in Isle of Wight County, Virginia **Lisa Kolgan**, Nicholas Flanders, Peter Schafran, Isaiah Amos, Destiny Waag and Lytton Musselman	Updates about the current status and conservation of Jamaica's giant swallowtail (*Papilio homerus*) **Valerie Kramer** and Matthew Lehnert
11:00 AM	Tracking the spread of *Ficaria verna* (Fig Buttercup) in South Carolina **Jane K. Marlow**	First-year vegetation responses to fall wildfire in Southern Appalachian forests **Beverly Collins**, Kelder Monar and Sarah Workman	The native root hemiparasite *Agalinis fasciculata* damages commercial pine plantations **Lytton John Musselman** and Alan Wilson	Circularization of *Chlamydomonas reinhardtii* mitochondrial mRNAs place ribosomal binding sites upstream of leaderless transcripts **Bruce Cahoon** and Ali Qureshi	MultiEDA: An interactive exploratory data viewer for multivariate plot-based inventory data **Christopher Payne**	Systematics and phylogeography of a biologically invasive cosmopolitan freshwater snail, *Physa acuta* **Amy Wethington**

Time	Ecosystem and Landscape Ecology Ballroom-A	Symposium: Fire Season of the Southern Appalachian Region Ballroom-B	Plant Systematics Ballroom-C	Cell and Molecular Biology I Room 101	Population and Community Ecology I Room 106	Invertebrate Biology Room 107
11:15 AM	Modeling the Effects of Noise Propagation **Dakota Howard** and John Quinn	CONT. First-year vegetation responses to fall wildfire in Southern Appalachian forests **Beverly Collins**, Kelder Monar and Sarah Workman	A new *Habranthus* species (Amaryllidaceae) endemic to Mexico City **Ray Flagg**, Gerald Smith and Abisaí García-Mendoza	The Role of Myeloid NF-κB in Glioblastoma **Jennifer Bradford**	The Effects of Exotic Invasive Plant Species on Pollinator Biodiversity in a Deciduous Temperate Forest **Kylie Lawrence** and Darlene Panvini	Regional distribution of metals in the cuticle of cicada ovipositors **Matthew Lehnert**, Kristen Reiter, Gregory Smith and Gene Kritsky
11:30 AM	Creating an Ecological Niche Model of Distribution of American Plains Bison (Bison bison) East of the Mississippi River; With Implications for Reintroduction **Lyn Howe**		Plastid phylogenomic analysis of green plants: a billion years of evolutionary history **Brad Ruhfel**, Matthew Gitzendanner, Pamela Soltis, Gane Wong and Douglas Soltis	The Effects of E-Cigarette Exposure on Lung Cell Viability and Gene Expression **Margaret J. Kovach**, Christine M. Hale, Ethan A. Carver and Gretchen E. Potts	Assessing potential scavengers in a fragmented forest in Panama using baited cameras **Shem Unger**, Caleb Hickman and Kevin Murray	
LUNCH 11:45 AM – 1:15 PM						

Thursday PM, March 29th

TIME	Plant Physiology Ballroom A	Symposium: Fire Season of the Southern Appalachian Region Ballroom-B	Plant Floristics Ballroom-C	Cell and Molecular Biology II Room 101	Population and Community Ecology II Room 106	Herpetology Room 107	Symposium: Hurricane Impacts on Coastal Freshwater Systems Room 108
1:15 PM	A study of Autumn Olive (*Elaeagnus umbellata*) phenology and associated physiological traits that may facilitate its invasion of the understory of a Southern Appalachian forest **Emily Riffe**, Ivy Culver and Howard Neufeld	The role of recent and past fires in shaping the vegetation of Great Smoky Mountains National Park **Julie Tuttle** and Peter White	Status of Rare and At-Risk Plant Species of South Carolina Lowcountry National Wildlife Refuges **Keith Bradley**	Lycorine hydrochlorine induces a proliferative arrest in colorectal cancer cells. **McKenzie Roberts** and Chris Barton	A Forty-Seven Year Comparison of the Vascular Flora at Three Abandoned Rice Fields, Georgetown, South Carolina **Richard Stalter**, Jospeh Rachlin and John Baden	Preliminary Assessment of Movement Ecology in a West Tennessee Population of Alligator Snapping Turtles (*Macrochelys temminckii*) **Saidee Hyder**, Jon Davenport and Josh Ennen	Impact of land use on the formation potential of disinfection by-products along the Yadkin-Pee Dee River basin under 2016 Hurricane Matthew **Huan Chen**, Hamed Majidzadeh and Alex Chow
1:30 PM	A Quantitative Analysis of a Kale Hybrid, *Tronchuda beira* Grown on an Extensive Green Roof, Garden and EarthBox **Caroline Glover** and Darlene Panvini		Broad-scale biogeographic patterns in dispersal morphology among the Southern Appalachian mixed mesophytic flora **Samantha Tessel**	Amodiaquine, an anti-malarial compound, inhibits the growth of epithelial cancer cells in culture **Bailey Bergmann** and Chris Barton	The effect of exotic plant species on arthropod diversity within an urban temperate deciduous forest **Christien Jackson** and Darlene Panvini	Phenotypic responses of larval spotted salamander to natural and introduced predator kairomones **Christopher Cannon** and Jon Davenport	Role of hurricanes and drought in mortality of tidal forested wetlands using historical aerial photography **Thomas Williams**

TIME	Plant Physiology Ballroom A	Symposium: Fire Season of the Southern Appalachian Region Ballroom-B	Plant Floristics Ballroom-C	Cell and Molecular Biology II Room 101	Population and Community Ecology II Room 106	Herpetology Room 107	Symposium: Hurricane Impacts on Coastal Freshwater Systems Room 108
1:45 PM	Assessing functional reproductive biology among floral morphs in *Passiflora incarnata* in Putnam Co., Tennessee. **Elizabeth Jackson** and Shawn Krosnick	Can wildfire accelerate mesophication following long periods of fire exclusion in Appalachian forests? **Joseph O'Brien**, Nina Wurzburger, Kevin Hiers and Dana Carpenter	The vascular flora of the Red River Gorge in Menifee, Powell, and Wolfe Counties, Kentucky **Thomas McFadden** and Brad Ruhfel	*Lys-3* and *lys-8* gene expression in *E. aerogenes* and *B. thuringiensis* infected *C. elegans* **Natalia Furr**	Movin' on Up: Mycorrhizal Mutualisms and Assisted Migration of Coastal Plant Species **Bradley Delfeld**, Loretta Battaglia, Pamela Weisenhorn, Benjamin Morgan and Louise Egerton-Warburton	Survival and habitat selection of Eastern Box Turtles (*Terrapene carolina*) in fire-maintained forests **John Roe**	Response of a South Carolina Coastal Freshwater Forested Wetland to Extreme Weather Events **William Conner**
2:00 PM	Leaf and stem photosynthesis and phenology as determinants of the ability of *Rosa multiflora* to invade and persist in Southern Appalachian forest understories **Ivy Culver**, Emily Riffe and Howard Neufeld		Flowering synchrony, floral display, and reproductive success of an alpine cushion plant, *Silene acaulis* **Lucas Piedrahita**, Ellen Waddle, Elijah Hall, Grace Kendziorski, Megan Peterson and Daniel Doak	Cannabinoid Mediated Inhibition of Ovarian Cancer Cell Proliferation is Mediated via Oxidative stress **Bert Crawford** and Paul Bagavandoss	Environmental niche divergence in Southeastern *Kalmia* species; integrating phylogeny, community composition and ecology **Tesa Madsen-McQueen**, Emily Gillespie, Mike Madritch and Zack Murrell	Temporal partitioning of foraging in *Plethodon metcalfi* suggests intraspecific competition for food. **Andrew N. Ash**	Impact of Hurricane Matthew's storm surge on forests still recovering from Hurricane Hugo at the marsh-forest boundary in coastal South Carolina **Stefanie L. Whitmire**, Thomas L. O'Halloran, Thomas Williams, Bo Song, Skip Van Bloem and William Conner
2:15 PM	**COFFEE BREAK**						

TIME	Plant Physiology Ballroom A	Symposium: Fire Season of the Southern Appalachian Region Ballroom-B	Plant Floristics Ballroom-C	Cell and Molecular Biology II Room 101	Population and Community Ecology II Room 106	Herpetology Room 107	Symposium: Hurricane Impacts on Coastal Freshwater Systems Room 108
2:30 PM		Intervention and Impact: the human element of the Southern Appalachian 2016 fires **Nathasha James,** Meghan Downes and Karen Abt	Reappraisal of the distribution of *Rhododendron* (Ericaceae) in South Carolina **Charles Horn**,	CRISPR in the Undergraduate Classroom **Heather Evans Anderson**,	Genetic variability among populations of *Chamaecrista fasciculata (Fabaceae) occurs at small spatial scales* in the Southeastern U.S. **Mahboubeh Hosseinalizadehnobari nezhad**, and Lisa Wallace,	The Right Place at the Wrong Time: Maximizing Detection in Surveys of Green Salamanders (*Aneides aeneus*) **Walter Smith**, P. Nauss, K. Hamed,	Impacts of recent hurricanes on the upper Savannah River estuary **Jamie Duberstein**, William Conner and John, Jr. Salter,
2:45 PM		CONT. Intervention and Impact: the human element of the Southern Appalachian 2016 fires **Nathasha James,** Meghan Downes and Karen Abt	A Preliminary Vascular Plant Flora of the Bare Zone of the Copper Hill Basin, Polk County, Tennessee. **John Shelton** and Joey Shaw	Expanding the roles of exogenous fatty acids in Gram-negative bacteria Joshua Herndon, Chelsea Hobby, Lyssa Baker, Colton Morrow, Steven Symes and **David Giles**	Drivers of Bird-Dispersed Exotic Plant Species in the Southeastern United States **William Sipek** and Loretta Battaglia,	Ecology of aquatic larvae in the contact zone between two cryptic, parapatric salamander species **Carlos Camp**, E. Benfield, Jenine Brideau, Stephen Owensby, Keelan Passmore, Jessica Smith, Rajvee Vajani and Jessica Wooten	Temporal and Spatial Impacts of Hurricane Joaquin and Hurricane Matthew on Source and Drinking Water Quality **Hamed Majidzadeh**,

TIME	Plant Physiology Ballroom A	Symposium: Fire Season of the Southern Appalachian Region Ballroom-B	Plant Floristics Ballroom-C	Cell and Molecular Biology II Room 101	Population and Community Ecology II Room 106	Herpetology Room 107	Symposium: Hurricane Impacts on Coastal Freshwater Systems Room 108
3:00 PM		Discussion	Sedges of the Carolinas-A Conspectus **Bruce Sorrie**	Survival of *Staphylococcus aureus* on ultrasound transducer heads used in healthcare. **H. Spratt**, D. Levine, S. McDonald, S. Drake, K. Duke, C.y Kluttz and K. Noonan	Urbanization disrupts latitude size in 17-year cicadas **DeAnna Beasley**,	Herpetofauna Occurrence in Southern Atlantic Tidal Swamps **Sidney Godfrey**	**Discussion**
3:15 PM					The seed germination ecology of *Gentiana flavida*, an endangered species in Kentucky. **Christopher Adams**	A Genomic Assessment Of Diversity Within Watedogs (*Necturus*) **David Beamer**	
3:30 PM – 4:45 PM **Poster Session 2, Exhibitors, and Coffee** Presenters of ASB **even-numbered posters** (**1-172**) must be present at this time. **ALL posters must be removed at end of PM session**							
4:45 – 5:30 PM	**ASB 'State of Our Society' Members' Meeting** **Ballroom B - ALL MEMBERS ENCOURAGED TO ATTEND**						

TIME	Plant Physiology Ballroom A	Symposium: Fire Season of the Southern Appalachian Region Ballroom-B	Plant Floristics Ballroom-C	Cell and Molecular Biology II Room 101	Population and Community Ecology II Room 106	Herpetology Room 107	Symposium: Hurricane Impacts on Coastal Freshwater Systems Room 108
6:00 – 10:00 PM	**ASB Thursday Night Social** **Live Music, Food, Drinks, Games, and more Drinks!!!** **RipTydz Oceanfront Grille & Rooftop Bar** **1210 N Ocean Blvd, Myrtle Beach, SC 29577**						

Friday AM, March 30th

Time	Conservation Ecology I Ballroom-A	Evolution and Genetics Ballroom-B	Symposium: SouthEast Regional Network of Expertise and Collections (SERNEC) Progress and Prospects Ballroom-C	Animal Behavior Room 108	Scholarship of Teaching and Learning Room 101	Aquatic Ecology I Rooms 106-107
8:00 AM	Utilizing Digital Data from Natural History Collections for Conservation and Education Applications. **Jillian Goodwin**, Gil Nelson and Molly Phillips	Characterizing Phenotypes Associated with Glyphosate Resistance in *C. elegans* **Natalie Gauger** and Daniel Williams	Ripples in the pond: the impact of John Herr's life on botany in the Southeast **Zack Murrell**	The effects of various pathogens on cortisol levels of *Danio rerio* measured from holding water compared to full body collection **Kara Garrett** and Lori McGrew	Enhancing undergraduate studies utilizing field stations and study abroad **Danielle Satre** and Aliya Davenport	Plants versus salamanders: the effects of competition on spotted salamander and bladderwort life history.**Jon Davenport**, Alex Riley and Peter Constantinides

Time	Conservation Ecology I Ballroom-A	Evolution and Genetics Ballroom-B	Symposium: SouthEast Regional Network of Expertise and Collections (SERNEC) Progress and Prospects Ballroom-C	Animal Behavior Room 108	Scholarship of Teaching and Learning Room 101	Aquatic Ecology I Rooms 106-107
8:15 AM	The role of species abundance in determining risk of extinction caused by habitat loss **Ryan Almeida** and Kevin Smith	Cytogenetic tools to investigate the compilospecies **Alyssa Phillips** and Matt Estep	John M. Herr, Jr and the Southern Appalachian Botanical Society **Charles Horn**	Swimming kinematics of loggerhead sea turtles during their first year of life **Kelly Zalaskus**, Soraya Bartol and Ian Bartol	Music and karaoke videos: teaching tools for biology/ecology/evolution. **Gary Grossman**	The Effect of PH on a Freshwater snail's (*Elimia laqueta) ability to detect predator and alarm cues.* **Dylan Adler** and John Niedzwiecki
8:30 AM	Mercury liver residues in Raptors collected in the Carolinas **Scott Weir** and Jeffrey Thomas	The Genetic Assessment of Bass species inhabiting three lakes in Georgia. **Michael Erwin** and Elizabeth Harrison	John M. Herr, Jr. at the University of South Carolina: a legacy. **John Nelson**	Habitat preference and herbivory effects in a rare plant preserve with reduced human interaction **Byron Burrell** and Matt Estep	Taking Chances, Getting Messy, and Making Mistakes: Taking Cues from Ms. Frizzle to Teach Critical Thinking to Environmental First Year Students. **Stephanie Jeffries**	Invasive Asian clam, *Corbicula fluminea*, Impacts on the Indigenous Benthic Community **Terry D. Richardson**
8:45 AM	Visitor Perceptions of White Nose Syndrome Management **Julia Portmann** and Michael Bradley	Comparing Bass Species within Lake Chatuge and Lake Blue Ridge **Brianna Harris**, Michael Erwin and Elizabeth Harrison	The Use Of Herbarium Specimens In Distribution And Dispersal Modeling And Conservation Planning: The Answer Is Blowing In The Wind. **Herrick Brown** and David Wethey	Discovery of Novel Quinoline Derivatives as Psychotropic Agents Using Zebrafish **Reid Loveless**, Ashley Williams and Vinoth Sittaramane	On Teaching Big Ecology: How Do You Maintain Optimism When Teaching a Course on the Future of Human Civilization, and More Importantly, Should You? **Howard Neufeld**	Poultry Rearing Facilities: Influences on stream nutrient concentrations and fish health in Upper Savannah River Basin **Kelly Detmer**, Ryan Lea Thomas, Greg Lewis and Dennis Haney

Time	Conservation Ecology I Ballroom-A	Evolution and Genetics Ballroom-B	Symposium: SouthEast Regional Network of Expertise and Collections (SERNEC) Progress and Prospects Ballroom-C	Animal Behavior Room 108	Scholarship of Teaching and Learning Room 101	Aquatic Ecology I Rooms 106-107
9:00 AM	Bird foraging behavior as an assessment of conservation efforts in the South Carolina Upstate **Natalie Ribble** and John Quinn	New Primers for Determination of Pathogenic Fusarium Species **Alexandra Agee** and Michelle M. Barthet	Putting Arkansas on the map: Georeferencing Arkansas herbaria **Diana Soteropoulos**, Jennifer Reed, Dylan DeRouen and Travis Marsico	Trade-offs between social dominance and running economy in male house mice **Jeremy Morris**, James Ruff, Wayne Potts and David Carrier	Using life history data to examine trade-offs in body size and reproductive ability **Matthew Heard**	An examination of UV radiation tolerance and photoenzymatic repair capabilities across temperature in the freshwater cladocerans Scapholeberis mucronata, Diaphanosoma birgei, and Moina spp **Harrison Seitz** and Sandra Cooke
9:15 10:30 AM	**BREAK for Poster Session 3, Exhibitors, and Coffee** Presenters of ASB **odd-numbered posters** (173 - 336) must be present at this time **9:15-10:30 AM**				Use of High-Impact Practices to Enhance Student Learning in a Tropical Plant Ecology Course. **Aliya Donnell-Davenport**	Population Dynamics and Habitat Use of the Buck Darter (*Etheostoma nebra*) in Buck Creek, Cumberland River Drainage, Kentucky. **Davy Black**
					Poster Break 9:30-10:30 AM	

Time	Conservation Ecology I Ballroom-A	Evolution and Genetics Ballroom-B	Symposium: SouthEast Regional Network of Expertise and Collections (SERNEC) Progress and Prospects Ballroom-C	Animal Behavior Room 108	Scholarship of Teaching and Learning Room 101	Aquatic Ecology I Rooms 106-107
10:30 AM	Influences on the Presence of Invasive Plant Species within Old Growth Forest of Lilley Cornett Woods **Jacob Peters**, Jennifer Koslow and Alex Baecher	Patterns of plastome degradation in the Buchnereae clade of Orobanchaceae **Christopher Randle**, Wen-Bin Yu, Jeffery Morawetz, Craig Barrett and Claude dePamphilis	Flora of Stone Mountain based on Digitized Specimens in the University of Georgia Herbarium **Ella Vardeman**, Steven Hughes, Wendy Zomlefer and David Giannasi	Intruder Alert! Fiddler Crab Response to a Same Species Invader **Carley Metcalf**	SPARC Scholars program yields significant positive effects on some, but not all, measures of STEM undergraduate student success in an at-risk population. **Holly Boettger-Tong**, Brooke Bennett-Day and Vivia Fowler	The legacy effects of a transient apex predator in a freshwater food web **Dustin Garig**, Josh Ennen and Jon Davenport
10:45 AM	Potential Benefits of Reforested Agricultural Riparian Zones for Bat Communities **Matthew Harris**, Heather Griscom and Patrice Ludwig	Systematics of *Achlya* spp (Oomycota) with emphasis on pathogenic isolates **J. Craig Bailey** and Jase Owens	Using SERNEC data to improve understanding of the distribution of sedges in the Carolinas **Bruce Sorrie**	Behavioral responses of physid snails to predators depends on predator diet **Clifton Ruehl** and Mary Kathryn Wright	A user-guide for implementing a student-centered introductory biology course **Tracy Deem**	Parasite Communities of Cormorants and Scaup roosting near aquaculture ponds in the southeastern US **Kate Sheehan**
11:00 AM	Assessing local and landscape measures to improve conservation management in the Piedmont Ecoregion **Emma Cook** and John Quinn	Indirect effects of a competitor on life history and reproductive traits in a cavity nesting bird **Sarah Britton** and Barbara Ballentine	Specimen digitization and crowdsourcing as a driver of productivity in undergraduate-dominated laboratories. **Emily Gillespie**	Use of Fitness-Based Habitat Selection Studies for Drift-Feeding Stream Fishes **Gary Grossman**	Improving the breadth of scientific communication skills through video **Jeffrey Thomas** and Patricia Koplas	Threatened and Endangered Species' Response to Raccoon Creek Stream Restoration **Alexandria Lamle**, Bill Ensign, Katie Owens and Brett Albanese

Time	Conservation Ecology I Ballroom-A	Evolution and Genetics Ballroom-B	Symposium: SouthEast Regional Network of Expertise and Collections (SERNEC) Progress and Prospects Ballroom-C	Animal Behavior Room 108	Scholarship of Teaching and Learning Room 101	Aquatic Ecology I Rooms 106-107
11:15 AM	Zoning does not improve the availability of ecosystem services in urban watersheds. A case study from Upstate South Carolina, USA **John Quinn** and Melanie Brown	Using deep learning to classify animal venom proteins. **Timothy Cole** and Michael Brewer	Building large digitization teams to achieve high digitization throughput of herbarium specimens. **Joey Shaw**, Caleb Powell and Ashley Morris	An outline of approaches that can be used for determining which moth species are pollinators **Daytona Hedrick**, Matthew Lehnert and Peter Van Zandt	Navigating the learning curve for students and the professor as we shift from traditional professor-led instruction to a more student-centered, student-engaging learning approach in biology education **Valarie Burnett**	The effect of non-detection of rare species on IBI scores **Will Commins** and Bill Ensign
11:30 AM		Correlations between the Serotonin Transporter (SLC6A4), Harm Avoidance, Excessive Alcohol Consumption and Extreme Sports in a population of College Students. **Erica Giron**, Ogechukwu Otiji, Matthew Schmolesky, Jill Penn and Jennell Talley	The Society of Herbarium Curators—A Dynamic, International Organization with Roots in the Southeastern US **Austin Mast**	Zebrafish larvae as a model to understand behavior development **Vinoth Sittaramane**, Ashley Williams, Reid Loveless and Shannon Wagner	Student Anxiety Impacts Performance and Persistence in Introductory Biology Courses **Ben England**[1], Jennifer Brigati[2] and Elisabeth Schussler	Biotic and abiotic impacts of chronic acid mine drainage in Dunkard Creek (Greene County) **Sara Hlatky** and Wayne Rossiter,

Time	Conservation Ecology I Ballroom-A	Evolution and Genetics Ballroom-B	Symposium: SouthEast Regional Network of Expertise and Collections (SERNEC) Progress and Prospects Ballroom-C	Animal Behavior Room 108	Scholarship of Teaching and Learning Room 101	Aquatic Ecology I Rooms 106-107
11:45 AM		Estimating heritability in thermal tolerance and identifying stress markers that correlate to survival at higher temperatures in *Acropora cervicornis*. **Kelsey Yetsko** and Matthew Gilg **Lunch 12:00 PM – 1:15 PM**	**LUNCH 11:45 AM – 1:15 PM**			

Friday PM, March 30th

Time	Conservation Ecology II Ballroom A	Symposium: Ecology in a High-speed Landscape Ballroom B	Plant Collections and Herbaria Ballroom C	Animal Behavior/Entomology Room 108	Microbiology Room 101	Aquatic Ecology II Rooms 106-107
1:15 PM	Assessing the Fire History of Pilot Mountain State Park in North Carolina **Dane Kuppinger**	Long-term impacts of rising atmospheric carbon dioxide on coastal scrub-oak vegetation in Florida **Frank Day**	The Vascular Flora of Orchard Knob: A Peephole into the Historical Limestone Glades of Chattanooga, Tennessee **Alaina Krakowiak**, Andrea Kur and Joey Shaw	Examining treehopper maternal vibrational signals during simulated predator attacks **Breanna Coughlin** and Jen Hamel	Exogenous fatty acids alter phospholipid composition and influence virulence-associated phenotypes in *Klebsiella pneumoniae* **Rachel Peters**, Chelsea Hobby, Joshua Herndon, Colton Morrow, Steven Symes and David Giles	Environmental and phylogenetic effects on the dermal microbiome of Mobile basin sculpin (Teleostei: *Cottus*) **Josh Millwood**, Michael Sandel and David Neely
1:30 PM	Reptile and Amphibian Assemblages within a Restored Montane Longleaf Pine (*Pinus palustris*) Ecosystem **Miranda Gulsby**	Ecosystem engineering by a native shrub in coastal grasslands **Lauren K Wood**, Spencer Hays and Julie Zinnert	Arboretum development on the campus of Southern Adventist University **Michael Baranda** and Benjamin Thornton	Investigating the reproductive outcomes of prolonged copulations in *Anasa tristis* **Matthew Sears** and Jen Hamel	The Effects of Antimicrobial Peptides WAM-1 and LL-37 on Multidrug Resistant *Acinetobacter baumannii* **John Spencer**, Rowan Pitts, Rachel Pearson and Lauren King	A Short-Term Temporal Meta-Barcoding Survey of Planktonic Protists in Appalachia - Natural Tunnel State Park, Virginia **Bruce Cahoon**, Ashley Huffman, Megan Krager and Roseanna Crowell
1:45 PM	Using Predictive Modeling Software to Observe the Impact of Land Use Changes on Ecosystem Services **Jasmine Bui** and John Quinn	The amelioration of grazing and burial through physiological integration by a clonal dune plant **Shelby Meckstroth** and Jonathan Evans	A new application to avert transcription errors in digitization of Natural History collections: Stopping the "taxonomic telephone." **Caleb Powell**, Jacob Motley, Hong Qin and Joey Shaw	Understanding the interaction of vegetation, soil, and ant communities **La-Teisha Allen** and Kaitlin Campbell	Mobile Discovery: In search of new antibiotics in classroom and field settings **Elizabeth Bickenbach**, Erin Moore, Charles Wagner, Mickey Wilson and Slavko Komarnytsky	Structure, resilience, and fate of large river bacterial communities **Gary Schultz**

Time	Conservation Ecology II Ballroom A	Symposium: Ecology in a High-speed Landscape Ballroom B	Plant Collections and Herbaria Ballroom C	Animal Behavior/Entomology Room 108	Microbiology Room 101	Aquatic Ecology II Rooms 106-107
2:00 PM	The Southeastern Grasslands Initiative (SGI): Charting A New Course for Conservation in the 21st Century **Dwayne Estes**, Theo Witsell, Reed Noss and Alan Weakley	Avoidance or Tolerance? Adaptations of the sand dune herb *Hydrocotyle bonariensis* in response to high light **Heather Joesting**	Investigation into the Status of Non-native Plant Species in Tennessee Using the SERNEC Herbarium Database **Courtney Alley**	Predator and Prey Behavior in Two species of Tardigrade **Harry Meyer** and Nézira Akobi	An *in vitro* Analysis of the Relative Efficacies of Antibiotic Solutions vs. Antiseptics Used for Irrigation in Breast Augmentation Surgery **Victoria Noyes**, Henry Spratt, David Levine, Mark Brzezienski and Mathew Epps	Effects of temperature on microbial parameters associated with decaying plant litter in a stream microcosm experiment **Hunter Pates**, Vladislav Gulis, Amy Rosemond and Jonathan Benstead
2:15 PM	Food web ecology and keystone effects of an endemic pond-breeding salamander **Kenzi Stemp**, Tom Anderson and Jon Davenport	Seagrasses in Transition **Jessie Jarvis**, Stephanie Kamel, Brandon Puckett, Amy Bartenfelder, Avonelle Combs and Jud Kenworthy	Developing and Testing Expedient SERNEC Data Entry Solutions: a proposed modification to the SERNEC/Symbiota portal to speed data entry from images. **Jacob Motley**, Caleb Powell and Joey Shaw	Structural Components in Sucking Mouthparts of Insects **Alison Arling**, Suellen Pometto, Charles Beard, Peter Adler and Konstantin Kornev	Investigating the use of quorum sensing molecules in the pathogenic pathway of *Bacillus thuringiensis* in *Caenorhabditis elegans* **Brooke Pugsley** and Robert Grammer	A new interpretation of chronological ages of *Latimeria chalumnae* and other coelacanths **Frances Woolfolk**, Michael Newbrey, Hugo Martín-Abad and John Maisey
2:30 PM	**COFFEE BREAK**					

Time	Conservation Ecology II Ballroom A	Symposium: Ecology in a High-speed Landscape Ballroom B	Plant Collections and Herbaria Ballroom C	Animal Behavior/Entomology Room 108	Microbiology Room 101	Aquatic Ecology II Rooms 106-107
2:45 PM	Development of an Avian Index of Biological Integrity for Kentucky Wetlands **Kaitlyn Kelly** and David Brown	Going, going, gone: coastal floodplain forest disassembly and dynamics in the Louisiana Deltaic Plain **Loretta Battaglia** and Julie Denslow	A Montane Island Plant Digital Collection for Research, Education and Conservation **Kathy Mathews**	Fitness Consequences of Genetic Variation in Wolbachia Infected Wasps **Sarah Killeen**	Metabarcoding Analysis of Cave Prokaryotic Microbiomes in Southwest VA **Brandon Thompson**, Robert VanGundy and Bruce Cahoon	Fertilization of green sea urchin, *Lytechinus variegatus,* negatively impacted by increasing temperature and acidity **Cady Sliger**, Virginia Fleer, James Wetzel and Darlene Panvini
3:00 PM	Range-wide *ex situ* seed conservation and population genetic architecture analysis in Venus flytrap (*Dionaea muscipula*) **John L. Randall**, Jamie Winshell, Corbin D. Jones and Gregory P. Copenhaver	Stress mediates community assembly processes in coastal ecosystems **Joseph Brown** and Julie Zinnert	WeDigFLPlants—Innovative, place-based citizen science engagement to build the most complete historical baseline possible for Florida's plants **Austin Mast**	The effects of *Wolbachia* bacterium on the *Trichogramma* populations **Tanya Stowell** and James E Russell	Variables affecting community composition of fish gastrointestinal microbial flora **Daniel Delgado**, Peter Sakaris, Sharon Keller, Wendy Dustman, Alexandra Lee Kutz and Rebekah Ward	Diversity and Abundance of Meiofauna Taxa with Contributing Abiotic Factors on Nannygoat Beach, Sapelo Island, Georgia **David Turner**, Sharon Blackwell, Richard Settele, Andrew Shirley, Logan Young and Nancy Dalman

Time	Conservation Ecology II Ballroom A	Symposium: Ecology in a High-speed Landscape Ballroom B	Plant Collections and Herbaria Ballroom C	Animal Behavior/Entomology Room 108	Microbiology Room 101	Aquatic Ecology II Rooms 106-107
3:15 PM	Investigation of the reproductive traits in the spiny dogfish (*Squalus acanthias*) off the GA/SC coast using microsatellite analysis. **Kathryn Craven**, Chloe Webb, Alexandria Ragsdale and Aaron Schrey	The effects of deterministic and stochastic processes on hardbottom community assembly through time and space **Zachary Long** and Wilson Freshwater	*On the effectiveness of illustration in modern botanical keys* **Andi Kur** and Joey Shaw	Flower feeding by butterflies: The adaptive value of having a smooth proboscis **Jamie Shell**, Daytona Hedrick and Matthew Lehnert	Examining the presence of *Escherichia coli* and fecal coliforms at Percy Priest Lake in Nashville, Tennessee **Hannah Forgani**, Chris Barton and Matthew Heard	Chlorophyll dynamics at high-energy beaches **Angelos Hannides**
3:30 PM	The effect of soil type, liming, and mycorrhizal inoculum on the cultivation of American Ginseng (*Panax quinquefolius)* **Emily Murray** and Heather Griscom	Mesopredator and human presence on a barrier island during sea turtle nesting season **Rachael Urbanek** and Zachary Taneyhill	Integrative taxonomic studies of the *Viola edulis* complex **Harvey Ballard** and Alex Greff	Swim Fast and Think Fast: Mobile Trout Make Faster Decisions Than Sedentary Ones **Charles Gowan**, Delaney Sheire and Emily Sprague	Community-Associated Antibiotic Resistance on a College Campus **Mary Catharine McKeithen** and Dave Wessner	Population biology of introduced barnacles, *Megabalanus coccopoma* and an unidentified species of *Megabalanus*, in the southeastern U.S. **J. Scott Harrison**
3:45 PM		Tree Swallow roost-site selection in human-dominated landscapes **Andrew Laughlin**, Daniel Sheldon, David Winkler and Caz Taylor				

Time	Conservation Ecology II Ballroom A	Symposium: Ecology in a High-speed Landscape Ballroom B	Plant Collections and Herbaria Ballroom C	Animal Behavior/Entomology Room 108	Microbiology Room 101	Aquatic Ecology II Rooms 106-107
4:00 PM – 5:30 PM **Poster Session 4, Exhibitors, and Coffee** Presenters of ASB **even-numbered posters (173 - 336)** must be present at this time. **ALL posters must be removed at end of PM session** **Closing Shenanigans, Raffles, and Tip Racking Contest**						
5:30 6:00 PM	**NSF Research Funding Opportunities in the Biological Sciences (all welcomed)** **Ballroom B**					
6:30 9:00 PM	**ASB Awards Banquet** **Ballroom DE**					

ASB Posters Presentations

Thursday March 29th • Posters 1–172

Odd # Posters presented (9:15–10:30 AM)/ Even # Posters presented (3:30–4:45 PM)

March 30th • Posters 173–336

Odd # Posters (9:15–10:30 AM)/ Even # Posters presented (4:00–5:30 PM)

1	The effect of physiological loading on cortical bone remodeling in white-tailed deer proximal humerus. **Jack Nguyen**
2	**Relative Size of the Zygomaticomandibularis Muscle in Frugivorous and Animalivorous Mammals: A Comparative Study of Jaw Adductors in Bats and Carnivorans.** J. S. Davis, J. W. Allen
3	**Coupling Kinematic Science with Animation Software: Can Reducing Animated Frames Improve Visualization?** Jillian S. Davis, Christian McDermott
4	**Quantification of Mitragynine in Kratom Tea Using High-Performance Liquid Chromatography** Tracy Davis, Heather Clontz, Kayla Bonilla
5	**The Effects of Chronic and Binge Ethanol Feeding and Kratom Consumption of Liver Dysfunction in Male Mice** Tracy Davis, Kayla Bonilla, Kinae Ogle, Carsyn Patton
6	**The Effect of Kratom on Fetal Development in Mice** Tracy Davis, Kinae Ogle
7	**A Comparative Analysis of Muscle Fiber Characteristics Across Feeding Modes and Breaching Behavior in Shark Species** Ashley DeLeon
8	**Annual Cicada Species Response to a Total Solar Eclipse** Caryn Ross
9	**Effect of body orientation on vibrational sensitivity of the terrestrial snail *Helix pomatia*** Eric Bauer, Emma Lavandosky
10	**Atmospheric CO_2 Enrichment and Foraging Preference in the Detritivorous Isopod, *Armadillidium vulgare*** Terry D. Richardson, Andrew C. Suddith
11	**Do Tree Swallows Settle in an Ideal Free Distribution?** Kevin Smith, Mark Stanback, Logan Morris
12	**The effects of turbidity on mate choice in the guppy *Poecilia reticulata*.** Lisa Cantwell, Jenna Hojnacki
13	**Intraspecific variation in social systems of Artiodactyla and Perissodactyla** Carsten Schradin, Loren Hayes, Monica Miles
14	**Vibrational behavioral sensitivity of the terrestrial snail *Helix pomatia*** Eric Bauer, Ellen Montgomery
15	**Ectoparasite Induced Behavioral Changes in Harvestmen.** Virginia Young, Michael Moore, Amy Varghese, Sarah Burch
16	**Reaction behavior of the ant species *Nylanderia faisonensis* during sequences of interactions with *Aphaenogaster carolinensis*** J. Thomas Looney, Timothy Menzel
17	**The Effects of Sex, Kinship, and Neonate Social Environment on Spatial Associations in Pygmy Rattlesnakes** Holly Molinaro, Sarah Smiley, Craig Lind, Terence Farrell
18	**Impact of antiepileptic drugs on habituation learning in zebrafish (*Danio rerio*)** Linda Niedziela, Madeline Wetterhall

19	**Social interactions in a maternal colony of big brown bats (*Eptesicus fuscus)*** Christopher Nicolay, Meredith Long
20	**Scaring the silk out of spiders: The use of defensive silk in response to threatening, biological stimuli in the western widow spider (*Latrodectus hesperus*)** Alphie Rotinsulu
21	**Preliminary Investigation of Shorebird Diversity and Foraging at Two Beaches in Northeast Florida** Natasha Vanderhoff, Melissa Rogers
22	**Effects of Breeding Stage and Behavioral Context on the Singing Behavior of Male Horned Larks (*Eremophila alpestris*)** CareyJo Titus
23	**Acoustic surveys shed light on the bats found at Eastern Kentucky University** Luke Dodd, Julia Portmann
24	**Determinants of Social Behavior in Captive North American River Otters (*Lontra canadensis*).** Janice Chism, Olivia Beasley
26	**Steroid hormone levels as an indicator of personality and aggression in brook trout (*Salvelinus fontinalis)*: A potential animal model for aggression** M. Bardi, Charles Gowan, Emily Ploppert
27	**Mobbing Behavior in Response to Avian or Terrestrial Predators** Peter May, Cody Hurst
28	**Testing the Effects Traffic Noise have on Birds within Warner Park** Haley Powell
29	**Spectral Characteristics of Harmonics in the B-Call of Hatchling Chinese Blue-breasted Quail (*Coturnix chinensis*).** Edward Mills
30	**Unlocking Ancient Carnivore Ecology with Contemporary Feeding Experiments** D. Patterson, J. Patterson, J. Williamson, K. Pepper, S. Blackwell, K. Allen, C. Duckworth, T. Bennett
31	**Alarm Cue Detection in Embryonic Cuttlefish** Dragos Amarie, Vinoth Sittaramane, Jessica Bowers
32	**Climate change and the *Ixodes spp*: Optimal chance for parasite distribution, disease transmission and opportunistic infection** Cynthia Johnson, Ruel Michelin, Mary Gutierrez, L. Frederick
33	**The Impact of Crab Pot Distribution on Diamondback Terrapin Presence In the Waters Around Masonboro Island, North Carolina** Amanda Williard, Hope Sutton, Mallory Munden
34	**Impact of Natural Disturbance on the Growth and Survival of the Endangered Schweinitz's Sunflower (*Helianthus schweinitzii*)** Kunsiri Grubbs, David Bailey
35	**Determinants of dragonfly community structure at several spatial scales: implications for conservation** Wade Worthen, Mara Chamlee
36	**The Effect of Competition and Light on the Growth and Survival of American Chestnut Hybrid Seedlings in Southern Appalachian Cove Forests** Heather Griscom, Cassie Stark, Zoe Bergman
37	**Single nucleotide polymorphism (SNP) analysis of *Symphyotrichum georgianum* from large and small Georgia, South Carolina, and North Carolina populations.** Danny Gustafson, Luke Mills
38	**Genetic Origin of *Sarracenia* Hybrids from Western North Carolina** Jennifer Rhode Ward, Caroline Kennedy, Rebecca Hale, Christine Mowad, Dilan Rivera

39	**Evaluating current species boundaries between *Liatris helleri* and *Liatris turgida* using high-resolution microsatellite markers** Matt Estep, Logan Clark
40	**Assembling a molecular toolkit for *Geum geniculatum* Michx.** Matt Estep, Marietta Shattelroe
41	**Investigating the ecology and habitat modeling of Solanum conocarpum on St. John, USVI** Heather Griscom, Cecilia Rogers
42	**Comparing nutrient uptake efficiency of Nitrogen and Carbon in Hydroponics and Soil grown *Phaseolus vulgaris* (Blue Lake Bush Beans)** Joe Schosky
43	**Water Usage In Hydroponic and Soil Based Agriculture** Michael Sharpe
44	**Relationships between European Honey Bee Health and Foraging Preferences on a University Campus** D. Wimert, G. Cristobal, B. Dimas, M. Farley, R. Hagevik, K. Campbell, G. Wood, H. Swartz
45	**Pollinators of Blue Ridge Parkway: A Citizen Science monitoring project** Jennifer Geib, Chloé Prunet
46	**Comparing nutrients and quality of aeroponically grown lettuce versus lettuce purchased from a grocery store.** J. Ganezer, Matthew Miller, Jennifer Albert, Danny Gustafson, R. M. Cudd
47	**Effects of habitat and coyote (*Canis latrans*) presence on site occupancy by white-tailed deer (*Odocoileus virginianus*) and feral cats (*Felis catus*)** Kirstie Mundok, Briget Doyle, Jessica Cuadra, Lindsay Arthur, Jonathan Storm
48	**Agent based modeling of the dilution effect of diversity in the Lyme disease system** Tessa Jones, Kevin Smith
49	**Habitat Use by Waterfowl on Former Surface Mines and Natural Wetlands in the Virginia Coalfields** Walter Smith, Kyle Hill
50	**GIS Mapping and Habitat Delineation of the Tater Hill Fen (Bog)** Matt Estep, Mary Butler Fleming
51	**Spatial distribution of terrestrial microplastic pollution: modeling debris abundance and distribution in Columbia County, Arkansas** Kate Sheehan, Catherine Sanchez
52	**Beech Bark Disease spread at Elk Knob State Park, NC** Mike Madritch, Patrick Latimer, Paige Byassee
53	**Changes in spatial distribution of Southeastern salamanders in the Blue Ridge region with respect to future climate change scenarios** John Quinn, Emily Anderson
54	**Using Geographic Information Systems to Construct a Predictive Model for the Occurrence of Invasive Plant Species in Northeast Georgia** Seth George, River Hodges, Jessica Smith, MacKenzie Devine, Timothy Menzel
55	**The Margays of Wildsumaco** Travis Knowles, Brian Arbogast, Paul Zwiers, Natasha Vanderhoff
56	**The relationship between ovenbird (*Seiurus aurocapilla*) territory location and topography at the Lillian E. Smith Center, Rabun County, Georgia** Mckenzie Latta, Timothy Menzel
57	**Hooded warbler (*Setophaga citrina*) occurrence in relation to vegetation structure and the presence of invasive plant species at the Lillian E. Smith Center, Rabun County, Georgia** Austin Miller, Timothy Menzel

58	**Genetic Diversity and Population Genetic Structure of Seep Endemic *Xyris tennesseensis*** Carol Baskauf, Kala Downey
59	**Assessing Geographic Patterns of Genetic Variation and Gene Flow in North Carolina Populations of the Gopher Frog (*Rana capito*)** Brian Arbogast, Nathaniel Akers
60	**The Hunt for Bigleaf** Travis Marsico, Jennifer Bryant
61	**The influence of chronological age on the occurrence of intersex in Largemouth bass, *Micropterus salmoides*, in the Chattahoochee River drainage, Georgia.** Michael Newbrey, Elizabeth Klar, Amy Sibley, Jeramy Belt
62	**Investigating the effect of oxygen circulation on basil plant growth in an aquaponics system** Heather Joesting, Jonathan Pope, Chris Lee, Ellesse Petty, Sakile Johnson
63	**Fish Species Diversity and Abundance in a First-order South Carolina Stream** Thomas Kozel, Kaitlin Saxton
64	**Investigation of the presence and identity of polychlorinated biphenyl (PCB) congeners in the Coosa River and its Rome tributaries in Floyd County, GA.** Daniel Clayton, Jacob Case, C. Elsey
65	**Impacts of a chicken processing plant on phosphate and bacteria concentrations in an adjacent wetland and creek.** Elizabeth Dobbins, John Bryant
66	**Can you hear me now? Acoustic communication in Centrachids** Michelle Gallo, Jeff Steinmetz, Matthew Binchik
67	**Effects of Low Level Atrazine Exposure on Crayfish Development** Kyle J. Harris, Alexandra Reddy, Mark Blais, Shiloh Sooklal, Todd Allen, Caroline V. Williams, Mackenzie Lecher, Samuel M. Owens, Austin M. Minuto, Abbie H. Suttle, Nathan T. Chandler
68	**A stream continuum analysis of bacteria community assembly in association with crayfish and their symbionts.** L. T. Fischer, K. M. Bohrnstedt, M. M. Cooke, M. Becker, K. J. Harris, T.A. Keplar
69	**Identification of Parasites in Intermediate Hosts of Freshwater Digenetic Trematodes** Megan Gibbons
70	**Prevalence of Trematode Parasites in a Population of a Freshwater Snail, *Elimia sp.*** Terry D. Richardson, Aurora Green, Jessica Yeager
71	**Host Specificity of the Leech *Placobdella biannulata* on Appalachian Salamanders** Carlos Camp, Emily Bewick, Tyler Brock, Cayla Simmons, Rachel Matthews
72	**Chronic study on the effects of gibberellic acid (GA3) on the mortality and reproduction of freshwater daphnids** Fernando Cardenas
73	**Comparison of age and growth biology of 34 million year old stingrays from North Dakota to the extant *Dasyatis pastinaca*** Todd Cook, Clint Boyd, Persia Tillman, Michael Newbrey
74	**Indirect Effects of Inter-Kingdom Competition and Predator Cues on an Aquatic Vertebrate** Jon Davenport, Thomas Hastings, Danielle Kirsch
75	**The effectiveness of underwater visual census and seining in measuring fish abundance and diversity in three Central Florida springs** Kirsten Work, Coramarie Jennings

76	**Spatial Ecology of Fish Communities in Accokeek Creek, Virginia** Bradley Lamphere, Kait Brogan
77	**Investigation of Cohort Structure in the Invasive Aquatic Snail, *Bellamya japonica* (von Martens 1861)** J. Curnow, J. Bauer, J. Hains, T. Smith, L. Stoudemayer, A. Rzeczycki, E. Mason, V. Kolluru, M. Davidson
78	**Habitat and community differences in the historic and current range of the Buck Darter *(Etheostoma nebra)*** Alex Baecher, Davy Black, Sherry Harrel, Peter Grap
79	**The effects of predation pressure on pectoral spine allometry in Margined Madtoms (*Noturus insignis*)** Bradley Lamphere, Peter Grap
80	**Mercury Concentrations in Terrestrial and Aquatic Primary Consumers in Tennessee's Appalachian Mountains** Ryan Otter, Andrew Todd, Connor Olson, Gale Beaubien, Jaylen Sims
81	**Land use change and fish assemblages in Spotsylvania Co., VA from the 1980s to the present** Bradley Lamphere, Alyssa Zanzucchi
82	**HPLC Detection of the Possible Presence of 17-α-ethindyl estradiol in Treated Effluents Released from the Chattanooga Water Treatment Plant** Jacqueline Dulanto
83	A comparison of the number of growth cessation marks in otoliths and centra of Largemouth bass, *Micropterus salmoides* **Jeramy Belt, Elizabeth Klar, Michael Newbrey, Malina Rollins**
84	**Preliminary investigation of aquatic vertebrate diversity and anthropogenic impacts at Hurricane Creek, Lumpkin County, Georgia.** Jessica Patterson, David Patterson, Kaitlin Pepper, Isabella Michel, Katelyn Shook, T Bennett, J. Williamson, Kayla Allen, Cory Duckworth
85	**The Effects of Temperature on Exotic and Native *Daphnia* from the Mobile-Tensaw Delta** Robert Fischer, Melissa Pompilius
86	**Freshwater Sponges are Prevalent in Western North Carolina and Host Diverse Microbial Symbionts** Cole Easson, Christina Strobel, Victoria Skelly, David Corcoran, Allison Griggs, Cara Fiore
87	**Investigating the function of the xanthophyll cycle in the sand dune herb *Hydrocotyle bonariensis*** Heather Joesting, Sarah Gray, Jonathan Pope, M. Ellesse Petty, Christopher Lee
88	***Aiptasia pallida* as a model organism for thermal stress in cnidarians** Tammy L. Laberge, Wilkin Muñoz, Milagros De Pasquale
89	**The Genomic Effect of Heat Stress in *Aiptasia pallisa*** Milagros De Pasquale, Wilkin Muñoz, Tammy L. Laberge
90	**Stable isotope analysis (δ13C and δ15N) of blood and skin from mid-Atlantic loggerhead sea turtles (*Caretta caretta*)** Amanda Williard, Susan Barco, Samantha Badgett
91	**Effects of Wildfire and Interguild Competition on Fungal Decomposition in Western North Carolina Forest Soils** Jonathan Horton, Tallis Donnelly
92	**Germination of *Amaranthus caudatus* seeds when exposed to KCl** Sierra Kincaid, Karla Rangel Silva, Christy Carter
93	**Morphological, Genetic, and Environmental Characterization of an Unusual Population of *Isoetes* (Isoetaceae, Lycopodiophyta)** Mac Alford, Shannon Walker
94	**The impact of digging on the shape of rodent mandibles** Andrew McIntosh, Daniel Glidewell

95	**Sexual selection on male and female Ebony Jewelwing damselflies** Idelle Cooper, Melissa Encinias, Suzanne Allison, Anjali Batra
96	**Wolbachia Infection in *Trichogramma kaykai*** Kaitlin Killeen
97	**A biogeographic profile of the sand cockroach *Arenivaga floridensis* and its bearing on origin hypotheses for Florida scrub biota** Jason Bond, Michael Brewer, Trip Lamb
98	**Early Pleistocene ecosystem evolution and heterogeneity at East Turkana, northern Kenya as indicated by stable carbon and oxygen isotope data from mammalian enamel** D. Patterson, K. Allen
99	**Role of *Calopteryx* Wing Pigmentation in Conspecific Recognition and Mate Choice** Suzanne Allison, Idelle Cooper, Melissa Encinias
100	***Wolbachia infection frequency and evolution among mosquito (Culicidae) species*** James E Russell, Rebekah Williams
101	**Investigating Karyotype Evolution in the Genus *Sarracenia*.** Ryan Holland, Jeremy Rentsch
102	**Patterns and Drivers of Niche Evolution in Liatris, a Rapid Radiation** Douglas Soltis, Pamela Soltis, Anthony Melton
103	**Identifying the Molecular Components of Cold Nociception in *Drosophila melanogaster*** Susan Halsell, Rachel Barborek, Kendyl Combs
104	**SSIP1 is Required for SDG7-Mediated H3K36 Trimethylation in *Arabidopsis thaliana*** Xiaoyu Zhang, Sarah Saddoris
105	Do Correlations Exist between Harm Avoidance, Risk Assessment, the STin2 polymorphism, and Marijuana Use in College Students M. Schmolesky, J. Penn, J. Talley, E. Giron, O. Otiji
106	**Using Maximum Likelihood Networks to Infer Reticulation Events Between Lineages in the Northern Dusky Salamander Species Complex** David Beamer, Trina Phan
107	**Salamander-leech Mania: A Cautionary Tale** Carlos Camp, Jessica Wooten, Emily Bewick, Tyler Brock, Cayla Simmons
108	**Human Effects on Genetic Diversity in Two Cryptic, Parapatric Salamanders *(Eurycea* bislineata complex)** Emily Bewick, Daniel Whitson, Keelan Passmore, A. Duitsman, J. Smith, C. Camp
109	**Comparison of the Multiplex Primer Set to the P2/P8 Primer Set and the DNA Source used for the Molecular Sexing of Owls** Alana Jefferson
110	**Identifying Satellite Repeats in Grass Genomes** William Nelsen, Matt Estep, Claire Menard
111	**Development of microsatellite markers for diversity studies within the genus *Dicentra*.** Matt Estep, Lindsay Shields, Jessie Hatcher
112	**New genome size estimates for quillworts (*Isoetes*) and their application in species delimitation** S. Komarnytsky, J. Bolin, C. Hartwig, P. Schafran, V. Mandujano, K. Noyola-Alonso
113	**Cultivating quantitative skills in the next generation of scientists while building a phenotype library for knockout mutant plants.** Matt Rutter, Courtney Murren, April Bisner, Allan Strand
114	**Characterizing the Role of Hemocytes, Organs, and Tissues in the Clearance of Bacteria from Lobster Hemolymph** A. Montalvo, Brooks Crozier, Darwin Jorgensen, Sara Farthing, E. Spangler

115	**Prevalence and infection intensity of fungal pathogen *Batrachochytrium dendrobatidis* in the eastern newt (*Notophthalmus viridescens)* in relation to seasonal change** Matthew Becker, Caleb Kellam, Nick Eisele, Megan Duggins
116	**Characterization of the interactions between symbiotic microbes of the salamander *Desmognathus fuscus* and the fungal pathogens *Batrachochytrium dendrobatidis* and *B. salamandrivorans*** Matthew Becker, Casey Mahoney, Micah Burnham, Catherine Twomey
117	**Characterization of the Peaks of Otter Salamander Microbiome as an Innate Defense against Emerging Infectious Diseases** Katherine Bronson, Bethany Wildeman, H. Nelson, M. Becker
118	**Extended Spectrum Beta Lactamase Producing Enterobacteriaceae in North Georgia Water** Nou Moua, Lindsay McCuen
119	**Exogenous polyunsaturated fatty acids (PUFAs) promote changes in growth, phospholipid composition, membrane permeability and virulence phenotypes in *Escherichia coli*** David Giles, Rachel Peters, Steven Symes, Joshua Herndon
120	**Impacts of poultry rearing facilities on the abundance and genetic diversity of *Escherichia coli* in stream waters of the South Carolina Piedmont** V. Britt, G. Lewis, G. Elmore, Min-Ken Liao
121	**Impacts of Poultry Rearing Facilities on the Abundance of Total and Antibiotic-Resistant Heterotrophic Bacteria in Streams of the South Carolina Piedmont** M. Liao, G. Lewis, V. Britt, G. Elmore
122	**Effects of Fluoride Varnish and Sucrose on Cell Viability, pH, and Biofilm Formation of *Streptococcus mutans*** Julie Wilson, Austin Strellner, Ekta Parab, Jennifer McMillion, Elianna Largeman, Andrew Kumar, John Hetzel, Tevaris Haley, Joseph Gibson, Joshua Hill, Laronsia Cross, Avianna Cliatt, Rachel Pearson, Lauren King
123	**Determining the Antimicrobial Effects of Perillaldehyde** Michelle Thomas, Laura Schnoor, Rasheda Boachie
124	**Cherokee Indian Plants Native to Anderson County, SC: An in vitro antibiotic assay of various medicinal plants** Frank Norris, Dorota Abramovitch, Thomas Kozel, James Duduit
125	**Identification of Genes Involved in Fatty Acid-Mediated Chemotaxis in *Vibrio cholera*** David Giles, Emily Lindsay
126	**Characterization of Bacteria from Distinct Environments with Antimicrobial Activity Against ESKAPE Pathogens** Cody Postich
127	**Molecular monitoring of methicillin-resistant Staphylococcus aureus (MRSA) in a hospital setting: Correlative study of patient and environmental isolates** Colin Smith, David Levine, Jessica Ammon, Henry Spratt, David Giles
128	**Molecular and Microbiological Analysis of Yeast Samples Isolated from West Tennessee. N** Kevin Pitz, Caitlyn McClain
129	**The Isolation and Characterization of Antimicrobial Compounds from Bacteria Isolated in Sediments of the Cape Fear River** Kristen Adams
130	**The Role of Electron Bifurcation in Cellulose Degradation and Hydrogen Production in *Ruminococcus albus*** Rebecca Corley, Gerrit Schut, Eleanor Schut
131	**Bacterial Associates within the Gastrointestinal tract of the Coosa Darter *(Etheostoma coosae)*** Chris Steed, Matthew Fields, Chris Murdock, Mark Meade, Benjie G. Blair, Robert C. Watson
132	**Are *Vibrio vulnificus* in Oysters from the Timucuan Preserve Pathogenic?** Janel Clarisse Palomo

133	**Using *Microbacterium foliorum* as a Host for the Isolation and Subsequent Annotation of a Novel Bacteriophage Genome** Kristi Westover, Victoria Frost, Hallie Smith
134	**Isolation of Lytic Bacteriophage from Bio-solid Treated Soils: A Preliminary Study.** C. Brian Odom, Brandi Celia
135	**Comparison of antibacterial effect between *Hydrastis canadensis* extract and the alkaloid Berberine** Luke Scott
136	**Endospore Survival in High Temperature Lipids** Jeff Wiles, Ashley Williams
137	**Unique Environments and Novel Culture Methods for Isolating Antibiotic-Producing Bacteria in Southeastern North Carolina** H. Mignosa, K. Kiser, H. Heck, R.A. Heap, H. Young, A. James
138	**The Use of *Caenorhabditis elegans* N2 Model System to Investigate *in vivo* Interaction Between *Bacillus thuringiensis kurstaki* and a Novel Bacteriophage** Megan Weeks
139	**Detection of *Legionella pneumophila* and other *Legionella* species in commercial potting soil** Richard Watkins, Alecia Basile
140	**Evidence for Antimicrobial Properties in Fresh *Aloe vera* Gel Extracts** Ashley Lytle
141	**Vascular flora and wetland assessment of wetlands in the Red River Gorge Geological Area and Clifty Wilderness in Menifee and Powell counties of Kentucky** Brad Ruhfel, Calvin Andries
142	**Past, Present, and Future of the David J. Sieren Herbarium at UNC Wilmington** Darin Penneys, Amanda N. Chapman
143	**Digitizing the Tater Hill Plant Preserve Collections** Katie Krogmeier
144	**A Story Map of the Existing Collections of Augustin Gattinger** Erica Rylander, Caleb Powell, Joey Shaw, John Shelton
145	**Multi-year Comparative Analysis of Maple Species for Syrup Production** K. Kessinger, K. Hill, B. Munson, R. Huish, J. Peters
146	**Somatic embryogenesis in a critically endangered African violet** Michael Renfroe, T. Warner Lowry
147	**Chemically Induced Phytoextraction using Switchgrass by Exogenous Application of Plant Hormone (GA_3), Nitric Oxide Donor (SNP) and Plant Growth Regulator (DA-6).** Sigurdur Greipsson
148	**Coastal grassland species vary in tolerance to salinity and drought** Julie Zinnert, Audrey Kirschner
149	**Comparative Ecophysiology of Two High Elevation Conifers in the Southern Appalachian Mountains: The Importance of the Winter Season** Howard Neufeld, Rachel Jordan, Zane Sink
150	**Evaluation of different chelating agents used in lead (Pb) phytoextraction.** Sigurdur Greipsson
151	**Ginsenoside Profiles of American Ginseng (*Panax quinquefolius* L.) Populations in Western North Carolina** J. Horton, Jennifer Rhode Ward, John W. Brock, H. David Clarke, Andrew Warren
152	**The Lighter Side: Physiological Properties of Adaxial and Abaxial Surfaces in Leaves of 33 Different Spp. of Plants** H Neufeld, A Quint
153	**Teaching Soil Forming Factors: Topography using ESRI Story Maps** Patricia Carbajales-Dale, Mark Schlautman, Christopher Post, Elena Mikhailova, Michael Cope

154	**Teaching A Non-Majors Biology Online Lab Course** Daniel Kiernan, Pearl Fernandes
155	**Investigation of Potential Correlation between Mindset and Attitude towards Active Learning, in an Internationalized Non-majors Biology Class.** Marty Thomas, Pratima Darr, W. Dustman
156	**From classroom to trail: using a citizen science approach to study tree phenology and global change on a college campus** J. Kitchens, Alisa Hove, August Starck, Liesl Erb, A. Blount, A. Boyd
157	**Rocking Out in Cedar Glades: Activities to Promote K-12 Engagement in Ecology and Conservation** Kim Sadler
158	**Insects as a model for theme-based instruction in undergraduate ecology: aiming to enhance student learning while addressing the "natural history crisis"** Kara Lefevre
159	**Integration of Earth-Life interactions into Introductory Biology courses.** Roger Sauterer
160	**Case studies enhance basic concepts in undergraduate genetics course** Linda Niedziela
161	**Role-playing activities to demonstrate complex cellular processes** Elizabeth Harrison
162	**The UNCW Fish Collection: A Resource for Ichthyology Research and Education** Tom Lankford
163	**Recruit and Engage Math and Science Teachers - REMAST Phase II, Year 4, Newberry College, SC** Christina McCartha, Charles Horn, Marial de Lachica, Alexis Nystrom, Cynthia Aulbach
164	**Tying it all together: Understanding animal diversity and phylogenetics using string** Christopher Brown
165	**Next Steps: Measuring the Success of Efforts to Increase Student Engagement** Dawn Simms
166	**Helping Students Succeed: A Successful Redesign of an Introductory Biology Curriculum** Lisa McDonald, Emily Prince
167	**The impact of *Bio-Bridge*, a 2-year to 4-year institution bridge program, on student confidence and attitudes** J. Hurst-Kennedy, A. Cottrell-Yongye, C. Achat-Mendes, R. Simmons, D. Levy
168	**Integrating an inquiry-driven cell culture experience in an upper-level cell biology course** Chris Barton
169	**Why Science Matters: Personalizing Biology Through Citizen Science** Darlene Panvini
170	**The Biological Field Journal: Integrating Observation With Art** Ed Mondor, Michelle Tremblay
171	**Engendering a Culture of STEM Learning with a Unique Peer Supplemental Instruction Model** Thomas Mundie, Allison D'Costa, David Purcell, Clay Runck, Tirza Leader, S. Dekhane, Cynthia Johnson, Jamye Curry Savage, Katherine Pinzon, Benjamin Shepler, Rashad Simmons, Elizabeth Sudduth, J. Hurst-Kennedy, Judy Awong-Taylor, C. Brown, C. Anfuso, Cindy Achat-Mendes
172	**Using tardigrades for inquiry science and mentored scientific research** Diane Nelson, Holly Dunderdale, Karen Renzaglia
173	**Bio-Inspired Materials: Tensile Strength in the Butterfly Proboscis** P. Adler, C. Beard, T. Stepanova, K. Kornev, A. Kaczmarek
174	**Changes in Social Form Dominance of Invasive Fire Ants in a Carolina Bay (Antioch)** Lisa Kelly, Hannah Swartz, Grant Wood

175	**Spacial Sensitivity of the Proboscis of *Manduca sexta*** Jonathan Travis, Joaquin Goyret, Amanda Mayo
176	**Compiling a database for Bumble Bees (*Hymenoptera, Apidae, Bombus*) of the Southern Appalachian Mountains** Jennifer Geib, Alexia Tompkins, Melanie McMillan
177	**The impact of reclaimed surface mines on bee (Hymenoptera, Apoidea) communities in Southeastern KY** V. Peters, A. Dunaway
178	**Ant Diet Preference In Urban Environments** Hao Brooks, DeAnna Beasley, Itzel Guzman Hernandez
179	**Do Brown Widow Spiders Stay Close to Mom or Spin Away from the Nest?** J. Scott Harrison, Emily Knight, Trevor Roberts
180	**In Pursuit of Common Ground: Evaluation of Cross-Disciplinary Communication Effort between the Fields of Invasion Ecology and Biological Control** Travis Marsico, Rima Lucardi, A. Schulz
181	**Using real-time videography to analyze the clotting process of lobster hemolymph in response to acute bacterial challenge** Darwin Jorgensen, Sara Farthing
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Thank You for Attending

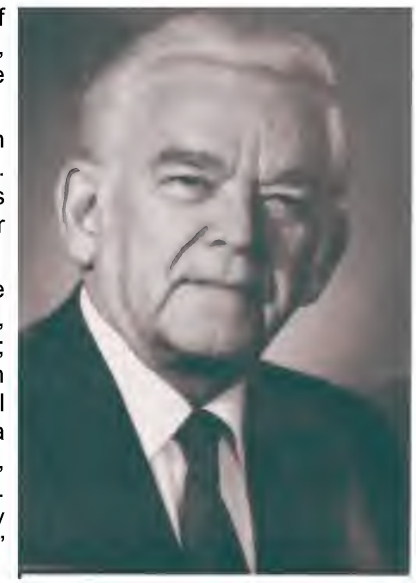
See you next year
in Memphis, TN!!

Wednesday, April 3 – Saturday, April 6, 2019

Memphis Cook Convention Center

OBITUARIES

Dr. Grover Cleveland Miller, Jr.
1927-2017



Dr. Grover Cleveland Miller, Jr., 90, of Smithfield passed away on Wednesday, May 3, 2017 at SECU Hospice House following a brief illness.

Dr. Miller was born on January 23, 1927 in Jackson, Kentucky, son of Grover Miller, Sr. and Hattie McQuinn Miller. He was preceded in death by both parents and four sisters.

Surviving are his children: Cindy Leslie and husband, Bill; Mark Miller and wife, Moni; Melissa Jensen and husband, Niels; Matthew Miller and wife, Susan; and seven grandchildren: Lauren Wolf (Luke), Will Leslie (Jessica), Nicole Howell (Ryne), Kyra Miller, Tyler Miller, Tenille Torres (Nelson), Devon Jensen; and five great-grandchildren. He is also survived by his loving wife, Judy Coley Miller, whom he called his “alter ego,” his life partner and soulmate.

Dr. Miller, a Professor of Zoology, retired from North Carolina State University in 1993 after 37 years of service. He taught over 15,000 students, both graduate and undergraduate. He published numerous articles in the field of Wildlife Parasitology.

Dr. Miller is a WWII veteran of the US Army, and was a Life Member in the American Legion. He served as a Past Commander, Chaplain, and Adjutant in Post 132 in Smithfield. He was also a member of La Societe des Quarante Hommes et Hunt Chevaux, 40/8.

Grover was an ordained Deacon and Elder in the First Presbyterian Church in Smithfield. Being an avid genealogy researcher, he also volunteered at the Heritage Library in Smithfield for many years.

The family will receive friends from 3 until 4PM on Sunday, May 7, 2017 at First Presbyterian Church in Smithfield, followed by a memorial service at 4 PM. The family has requested no flowers; however, memorial gifts may be made to First Presbyterian Church Building Fund, PO Box 1159, Smithfield, NC 27577, or to the Grover C. Miller Zoology Scholarship Endowment, NCSU College of Sciences, Campus Box 8201, 4216 Broughton Hall, Raleigh, NC 27695.

Executive Committee 1966-1968; President, 1971

Dr. Miller’s obituary was prepared by his wife, Judy Coley Miller, and by Dr. Raymond Flagg, retired biologist, Carolina Biological Supply Company, Burlington, North Carolina.

In Memoriam

Dr. Rebecca (Becky) Reyburn Sharitz
1944-2018

"**V**at? **A V**oman?" (What? A Woman?)" This was the question and challenge posed by a certain senior professor of Germanic origin to a female field ecologist at the beginning of her career many years ago. When Becky met this man as a new graduate student, he suggested that she might be better off developing secretarial skills rather than adhering to her chosen curriculum of science courses. Fortunately, none of the young women to which he gave similar advice listened and instead formed a loose organization to support one another, named the "**VAV**" society. One of the inaugural members was Dr. Rebecca Sharitz.

Dr. Sharitz, known as "Becky" to her friends, students, and colleagues, began her career at Roanoke College (B.S. Botany, 1966) and followed up at the University of North Carolina (Ph.D. Ecology, 1970). Her first academic positions were at St. Andrews Presbyterian College and then Saginaw Valley College before arriving at the University of Georgia's Savannah River Ecology Laboratory in 1972, where she spent the remainder of her career.

Becky's career was an illustrious one. She became a world-renowned expert on southeastern US floodplains and isolated wetlands. She authored or co-authored more than 160 peer-reviewed papers or chapters, co-edited three books, and was the recipient of over 40 significant research grants. Most notably, her research was the first to demonstrate important linkages between hydrologic characteristics and wetland forest regeneration following thermal releases from nuclear reactors, alteration from dams, and tropical storm events.

She served as Vice President and Treasurer of the Ecological Society of America, Vice President and Secretary-General of the International Association for Ecology (INTECOL) and as a panel member on four National Academy of Science committees. She was awarded the Meritorious Teaching Award by the Association of Southeastern Biologists and the Friends of Congaree National Park, Order of the Cypress. She was elected as a Society of Wetland Scientists Fellow and received the prestigious National Wetlands Award in Science Research by the Environmental Law Institute. Of all her achievements, Becky was most proud of the graduate students, post-doctoral fellows and volunteers that she mentored and trained.

Becky Sharitz, Professor and Senior Research Ecologist at the University of Georgia's Savannah River Ecology Laboratory, passed away on October 20, 2018. She was a true pioneer in her field of wetland ecology; she helped to launch the careers of many and left behind an impressively long trail of accomplishments.

Photo of Patricia Werner (left) and Becky Sharitz (right), two members of the "VAV" club, on a fieldtrip to the Northern Territory, Australia, 1981. The two often travelled together in the early days, including to the (then) Soviet Union, the UK, Ireland, Australia, and New Zealand. Scientific conferences were focus of these trips, but they also found time to climb Ayers Rock (Uluru) in Australia, land in an airplane on a NZ glacier and to fly faster than sound in a SST Concord. Photo courtesy of Pat Werner.

Photo of Becky (center) playing a game during fieldtrip to Congaree Swamp National Park. Photo courtesy of Priscilla Titus.

Photo of Becky Sharitz in the field. Photo courtesy of Linda Lee.

What A Woman! Indeed!
She made all the difference in my life. I will miss her forever. ---Loretta Battaglia

Excerpt from Adrienne Edwards' written account of a stormy night with Becky as they navigated their way out of the Congaree Swamp:
"Did you know that in some areas of shallow standing water, you can see the footprints of recent travellers floating up like ghosts? The bubbles of swamp gas carry up tiny bits of dust that create floating shadows on the water's surface.
--Adrienne Edwards, 1990
I feel sure that Becky's footsteps are floating there still.
--Adrienne Edwards, 2018"

Dr. Sharitz's obituary was prepared by Dr. Loretta Battaglia, Department of Plant Biology, Southern Illinois University, Carbondale, Illinois.

In Memoriam

J. Kenneth Shull, Jr. (1941-2018)

Ken Shull passed away peacefully at home on the evening of March 5, 2018. ASB has lost a stalwart supporter and long-term contributor to the organization. He is survived by his wife of 50 years, Carolyn Saxon Shull, two children, Kenneth and Gwyn, and two grandchildren. Ken was born in Anniston, Alabama, and grew up there, graduating from Anniston High School in 1959. He attended the University of Alabama, earning a B.S. in chemistry and an M.S. in biology. He then attended Florida State University, from which he earned a Ph.D. in genetics, under the tutelage of Prof. Margaret Y. Menzel, herself an early member of ASB and long-time editor of the ASB Bulletin. After completing his study of chromosome pairing during meiosis in lilies, he took a position as Assistant Professor at Loyola University in New Orleans, where he taught for eleven years and rose to the rank of Associate Professor and Chairman of the Department of Biological Sciences. In 1984, he moved to Appalachian State University as Associate Professor, where he taught until his retirement as Professor of Biology in 2007.

Ken took an active role in ASB from the start of his career. He served as chair of the Publication Committee, editor of the ASB Bulletin, chair of the 1991 Local Arrangements Committee, and chair of various other committees. He was elected Vice President in 1982 and President in 2002. From 2014 until his death, he was ASB Archivist. Notable among his many achievements was organizing and hosting the Boone Chromosome Conference for several years. He was chair of the Local Arrangements Committee for the 2009 International Chromosome Conference, the only meeting of this organization in North America. Ken received the ASB Meritorious Teaching Award in 2003.

Ken's contributions to ASB are too numerous to mention here, but all of us remember Ken's willingness to help in whatever way he could and his unflagging good cheer, even during his illness. He was emphatically not a complainer. ASB has lost a major contributor. He will be sorely missed.

Dr. Shull's obituary was prepared by Dr. Dwayne Wise, Department of Biological Sciences, Mississippi State University, Mississippi State, Mississippi.

Dr. Paul Yokley, Jr.
1923-2018

FLORENCE — Dr. Paul Yokley, Jr, 95, of Florence, passed away November 22, 2018. Visitation will be at Greenview Funeral Home from 6 to 9 p.m. on Monday, November 26, 2018. The funeral service will be at 2 p.m. on Tuesday, November 27, 2018 in Greenview Memorial Chapel with Larry D. Wright and Kevin Johnson officiating. Burial will follow in Greenview Memorial Park with military honors.

Paul was born in Mitchellville, Tennessee, near Portland, Tennessee, and graduated from George Peabody College with his B.S. Degree in 1949 and his Master's Degree in 1950. Immediately he began his 43-year teaching career at

Florence State Teachers College retiring from the University of North Alabama in 1993. While at UNA, he was the founder and advisor of the Beta Beta Beta Biology Honor Society. He served as the National Beta Beta Beta Vice President from 1978-2015.

Paul served in WWII in the United States Army Air Corp in Saipan, Guam, and other Asian countries, "piloting a bulldozer" for the Air Corps Engineers. He married Betty Brackin in 1946 and always said, "She was the prettiest girl I ever met."

Paul received his PhD Degree from Ohio State University in 1968. In the mid 70's he established the Yokley Environmental Consulting Service and worked many environmental impact research projects all over the southeast U.S. until 2016 (age 92)… AMAZING!

Paul was a member and deacon of First Baptist Church in Florence for 68 years where his "every Sunday morning greetings and hugs" will be greatly missed.

He was preceded in death by his wife, Betty Yokley; granddaughter, Haley Marie Creel and son, Dr. David Yokley.

Survivors include his daughter, Mary-jane Creel (Larry); grandchildren, Kevin Creel, Austin Creel, Daniel Creel, Audra Yokley and Taylor Yokley; great-grandchildren, Madeline Creel, Carter Creel, Haley Creel, Gracie Benson, Jackson Creel, Cameron Creel, Hunter Creel, Sadie Creel and Catherine Hamel.

Paul truly loved teaching and working with his grandsons, Kevin, Austin, and Daniel and his son-in-law, Larry, on his "gentleman's farm" at White's Lake and garden on Chisholm Road. Paul also loved these same grandsons camping, hunting, and working the land on his farm.

Serving as pallbearers will be grandsons and friends.

A heart-felt thank you to Mitchell Hollingsworth Nursing Home and especially to the Community Care Hospice Staff for their kind and tender care.

An online guest book may be signed at greenviewmemorial.com.

Dr. Yokley's obituary was published in the Times Daily *newspaper in Florence, Alabama, on Sunday, November 25, 2018, and submitted to the Journal Editor of* Southeastern Biology *by Dr. Donald H. Roush, Professor Emeritus of Biology, Department of Biology, University of North Alabama, Florence, Alabama.*

Dr. Roush added, "On Thanksgiving night Dr. Paul Yokley, a longtime member of ASB passed away after a courageous fight against cancer at the age of 95. Paul worked extensively with TriBeta and helped to forge the long association of TriBeta with ASB. He was a strong supporter of student research and after retirement from UNA (Department Chair at retirement), he continued with ASB and TriBeta into his late eighties, early nineties until travel became difficult. During that time, he missed meetings only with the death of his wife and later the death of his son. He did his first field survey at the age of 92. As a close frield

and travel companion for many, many years, my wife Kathy and I will miss our trips with Paul especially to ASB."

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Printed on Recycled Paper

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Publication Date: June 30, 2018

Printed on Recycled Paper

Southeastern Naturalist

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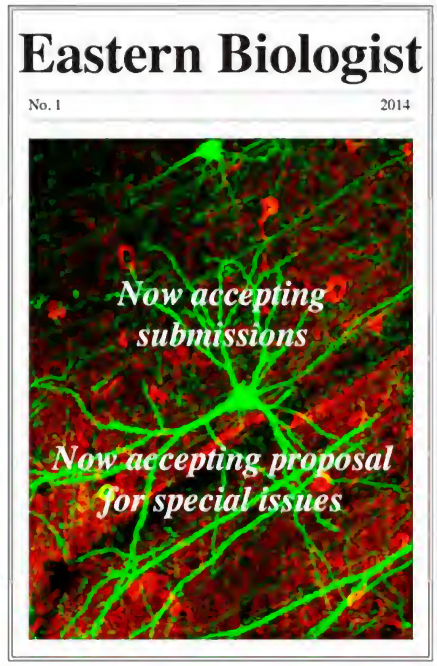

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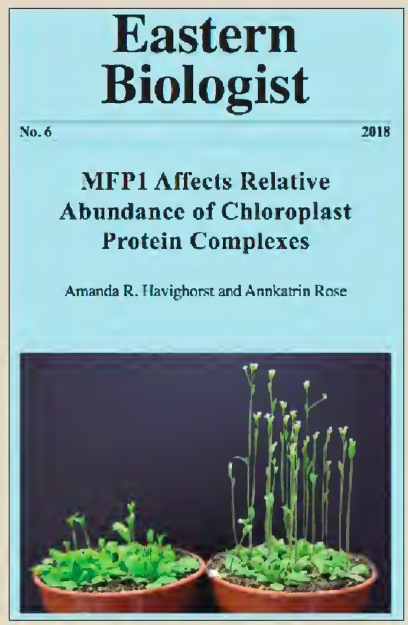

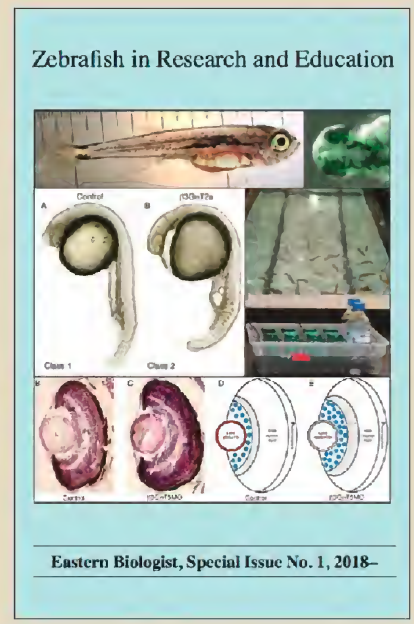

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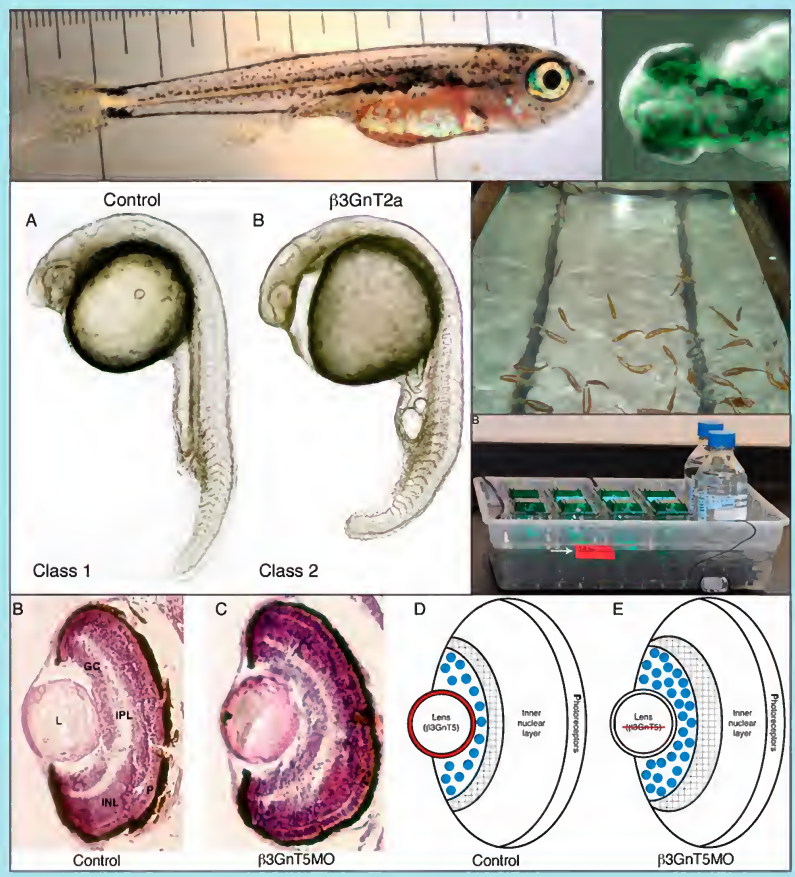

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Zebrafish in Research and Education

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Analysis of Genetic Interactions and Developmental Requirements of the β1,3-N-acetylglucosaminyltransferase Family During Zebrafish Development
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ASB membership includes discounts on annual meeting registration and on subscriptions to Southeastern Naturalist (SENA), the official journal of ASB.

To join or renew and pay by cash, check, or money order, complete contact information below, enclose cash or check/money order payable to Association of Southeastern Biologists, and send by mail. **To pay by credit card**, please log on to our membership management page (http://www.sebiologists.org/membership/) and use our secure online payment system. If you would like further information or have questions, contact **Tracy L. Deem, ASB Treasurer, Department of Biology, Bridgewater College, Bridgewater, VA 22812; (540) 515-3745; tdeem@bridgewater.edu.**

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SOUTHEASTERN BIOLOGY
VOLUME 65, Numbers 1-4, 2018
http://www.sebiologists.org

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